MAINTENANCE REQUIREMENTS FOR THE INFORMATION PROCESSING INDUSTRY 1978 - 1983

INPUT

ABOUT INPUT

THE COMPANY

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on importa
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MULTICLIENT PROGRAM

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Maintenance Requirements

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THE INFORMATION PROCESSING INDUSTRY

DECEMBER 1978

MAINTENANCE REQUIREMENTS FOR THE INFORMATION PROCESSING INDUSTRY

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I INTRODUCTION

I INTRODUCTION

- The primary objectives of this study on Maintenance Requirements For The Information Processing Industry In The U.S. were to:

  - Describe how the delivery and pricing of maintenance services will change as a result of new technology, competitive forces and increasing labor costs.

  - Evaluate the opportunities for non-manufacturers (e.g., computer services vendors) to offer maintenance services.

  - Determine the impact of the vendor's maintenance on equipment procurement decisions.

  - Investigate user requirements and how much they will pay for maintenance services.

  - Determine the extent that technology will contribute to the improvement of maintenance techniques.

  - Report the user's perception of various equipment vendors' maintenance capability.

  - Analyze the major personnel issues in maintenance organizations.

- Dimension the market for maintenance services over the period 1978-1983.

- The study examines applicable issues as related to the following categories of equipment:

  - Medium and large scale mainframe systems.

  - Small business computers.

  - Minicomputers.

  - Peripherals.

  - Terminals.

- Research for this study included both telephone and on-site interviews as specified in Appendix B.

- All forecasts are presented in current dollars.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. MAINTENANCE REQUIREMENTS, 1978-1983

- Vendor revenues derived from information processing maintenance services will increase at an average annual growth rate (AAGR) of 15% over the forecast period--from a 1978 base of $4.8 billion to $10 billion in 1983, as shown in Exhibit II-1.

    - This forecast, in current dollars, includes only the United States and excludes maintenance revenues for common carrier-supplied communications equipment and office equipment.

- During the same period, the dollar value of the installed base of information processing equipment will increase at an AAGR of 11-12% per year.

- In order to meet these increased demands, vendors would have to double the number of field service personnel over the forecast period, assuming that traditional maintenance methods and techniques continue to be used (see Exhibit II-1).

    - Vendors interviewed for this study claimed they would do exactly that.

EXHIBIT II-1

FORECASTED MAINTENANCE REVENUE AND PERSONNEL
1978 - 1983 (U.S. ONLY)

YEAR	MAINTENANCE REVENUE ($ BILLIONS)	MAINTENANCE PERSONNEL (THOUSANDS)		ANTICIPATED MANPOWER (THOUSANDS) SHORTAGE (DIFFERENCE)
		INPUT FORECAST	VENDOR PROJECTION	
1978	$4.8	90	90	-
1979	5.5	99	103	4
1980	6.4	110	119	9
1981	7.3	123	137	14
1982	8.4	136	157	21
1983	10.0	151	180	29
AAGR	15%	11%	15%	-

- However, INPUT believes that the industry will not be able to sustain that level of hiring and training and, in fact, that personnel growth will not exceed an 11% AAGR over the forecast period.

- This shortfall in people, illustrated in Exhibit II-2, will have major consequences for maintenance operations:

  - Many users will be forced to accept degraded performance.

  - Spares inventories and stocking locations will have to be increased.

  - R&D efforts for development of more efficient diagnostic and repair techniques will have to be intensified.

  - Companies who have difficulty attracting and holding people will find it even more difficult to compete with those firms (such as IBM and Hewlett-Packard) who have been traditionally able to staff and maintain a quality field service force.

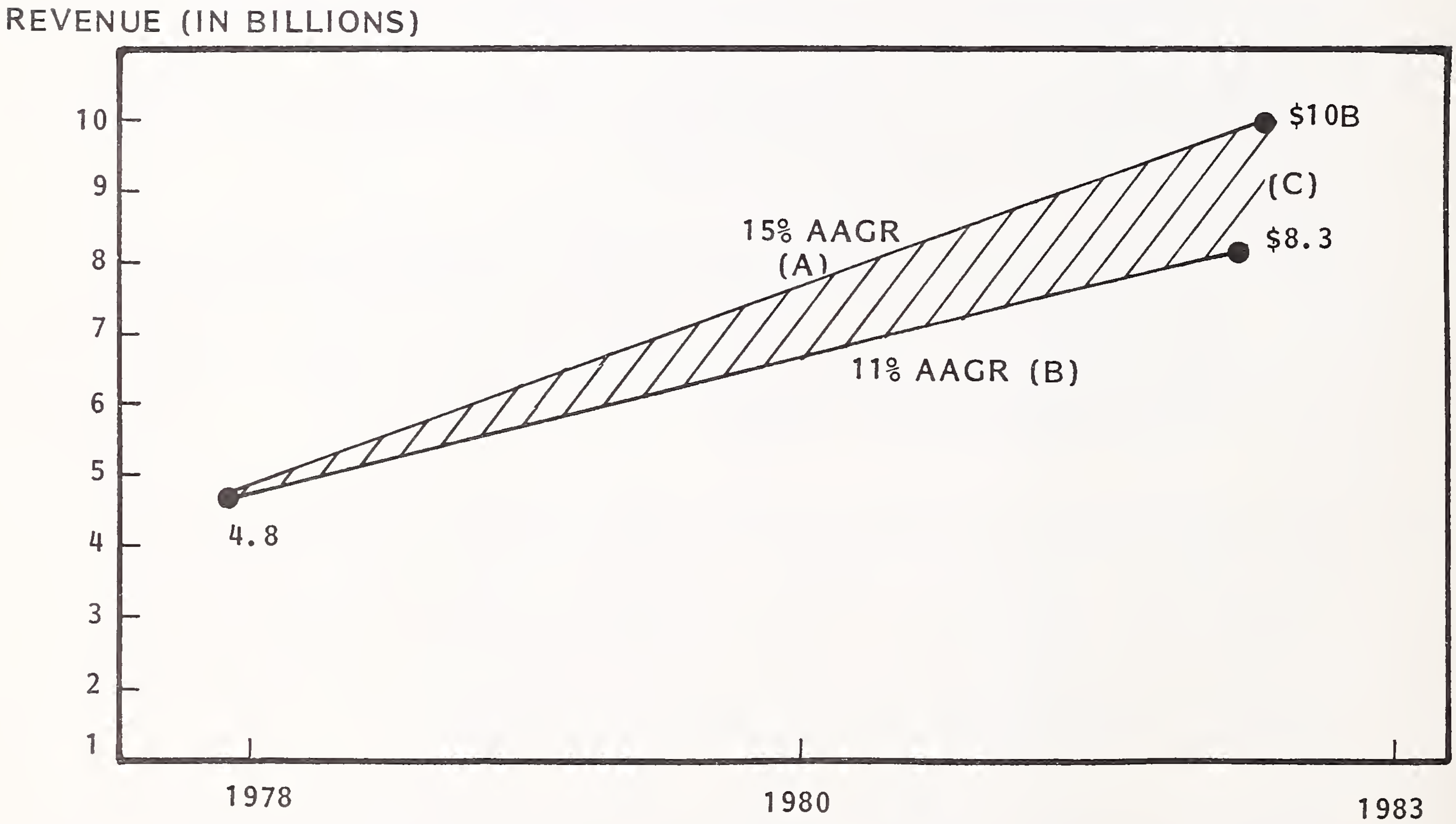
- In general, users today rank perceived reliability above all other factors as the key criteria of equipment selection. Thus, the maintenance function is a gating item to sales growth. Vendors who fail to recognize the importance of maintenance (and related activities such as spares stocking and quality assurance) will be at a distinct competitive disadvantage.

- Users do not expect maintenance charges to increase significantly as a percent of their overall EDP budgets, although they recognize that costs will go up along with everything else. However, INPUT found that users are not prepared for the degree of increase:

  - There is a "mental block" in the minds of most users that have established the figure of 15% of purchase price as an upper bound on annual maintenance costs.

EXHIBIT II-2

FORECASTED REVENUE VS. AVAILABLE FIELD ENGINEERS



A = MAINTENANCE REVENUE DEMANDED BY INSTALLED BASE.
B = MAINTENANCE REVENUE DERIVED FROM AVAILABLE FIELD ENGINEERS.
C = UNCOVERED MAINTENANCE REVENUE TO BE DERIVED IN NON-TRADITIONAL MANNER.

- As shown in Exhibit II-3, annual maintenance costs are expected to double in relation to hardware costs in five years. Depending on type of equipment, the 15% "barrier" will be encountered as early as 1979.

- The best way to deal with the problem is to shift a larger share of the maintenance responsibility onto the shoulders of the users themselves. This action implies that vendors must invest in the development of new programs designed to train and assist users in "self-help" efforts.

- Beyond the 1983 time frame (not scrutinized in this study), the latest generation of equipment will markedly impact the character of the installed base. Average mean time between failure (MTBF) will be much larger than on today's systems, and the maintenance demands of an average installation will be significantly less than they are today and over the next few years.

    - Board and unit level replacement will be the most common fix-it methods. The user will take a major share of the responsibility for this type of maintenance. In cases where on-site repairs by vendor personnel are still required, relatively unskilled people will be able to handle the job.

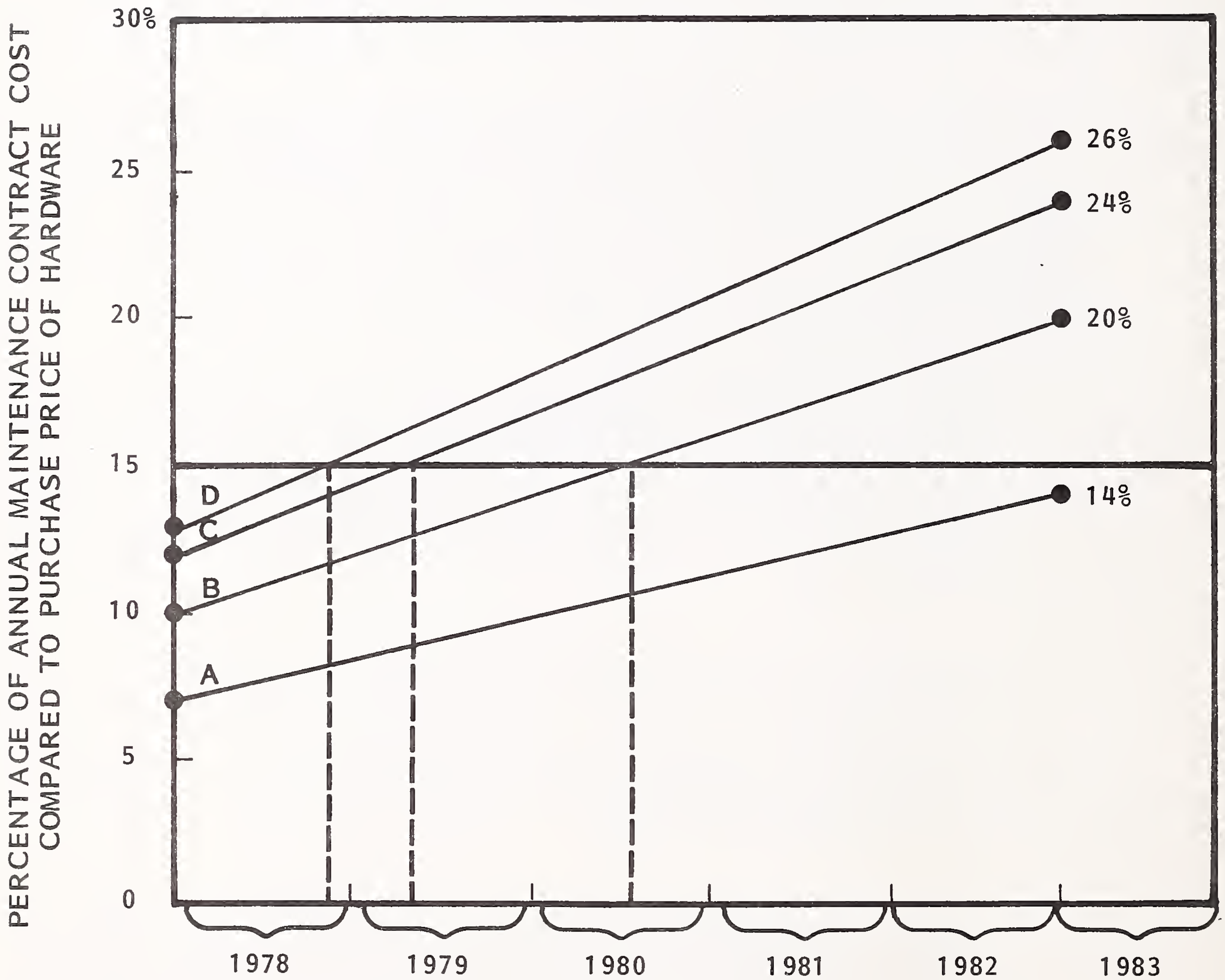
    - Diagnostics will be performed by the users or on a remote basis. Faults will be isolated to one of a small number of hardware modules. Component level repairs will be carried out only at the factory or centralized repair facilities.

    - Hiring, training, and skill requirements for field service personnel will be radically different than they are today. In fact, many companies will be faced with the problem of phasing out some of the people they currently employ.

- Exhibit II-4 is a schematic representation of the way in which requirements for field service will vary over the next decade. The chart shows that the most severe shortage of field service people will occur in the 1980-1981 period.

EXHIBIT II-3

FORECASTED GROWTH OF ANNUAL MAINTENANCE CHARGES FROM VENDOR PROJECTIONS

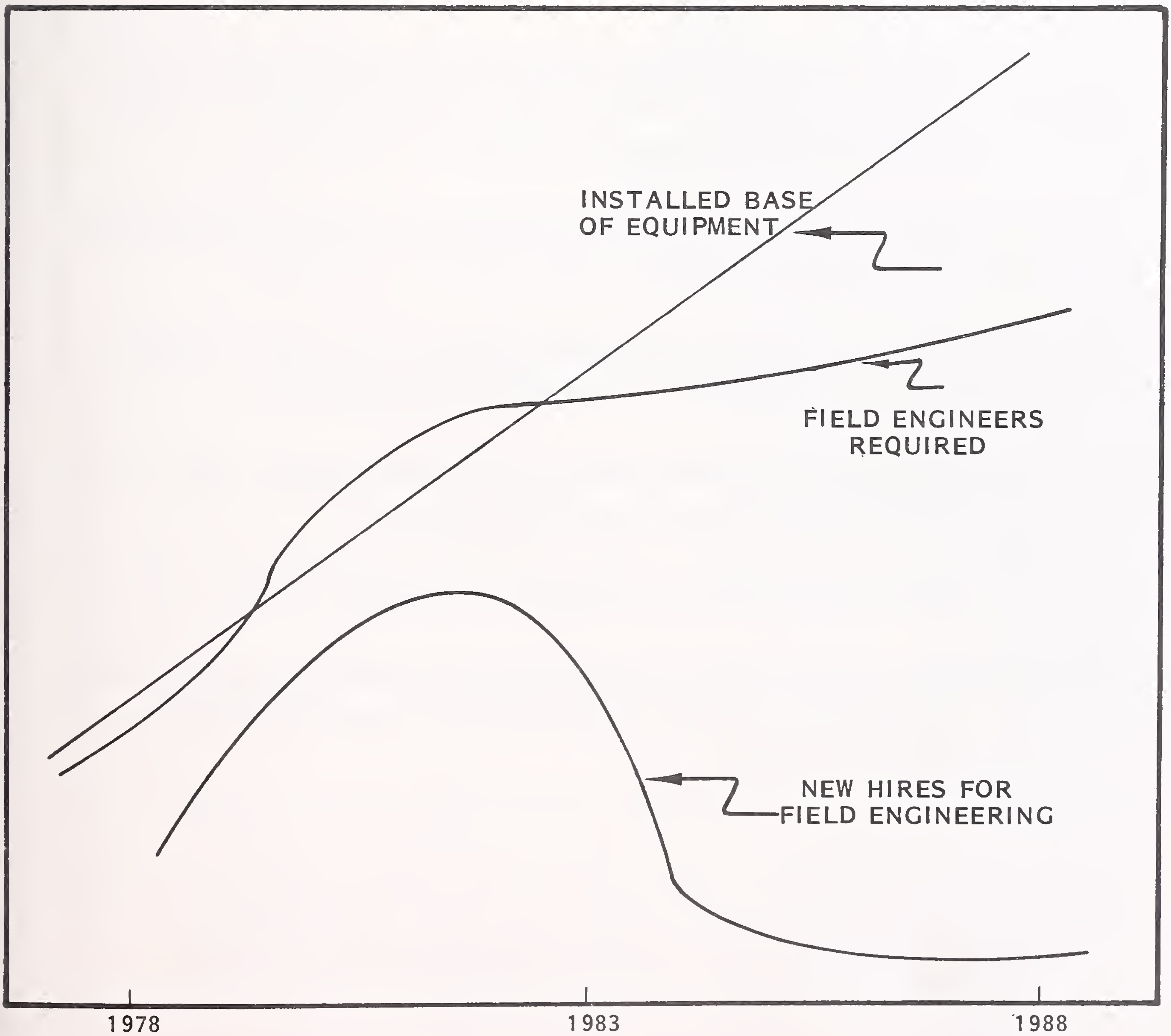


A = LARGE MAINFRAME SYSTEMS
B = MINICOMPUTERS, TERMINALS, AND OTHER
C = SMALL BUSINESS EQUIPMENT
D = PERIPHERALS

15% AAGR

EXHIBIT II-4

PROJECTED GROWTH OF FIELD ENGINEERS
VS. INSTALLED BASE



Vendors must establish a plan to deal with this critical phase and, perhaps just as importantly, establish a plan to "back off" once the critical phase has passed.

- One of the key driving forces facing maintenance organizations is the move to broader geographic dispersion of equipment with the advent of distributed data processing (DDP). INPUT's DDP forecasts indicate that by 1982, 30% of the total installed base of equipment will be operated in a DDP environment.

  - In 1982, 225,000 small business and minicomputer systems will be shipped domestically. Of these units, at least 50,000 will be utilized in a dedicated DDP environment.

  - In the same year, at least one-half million terminals of all types will be shipped in the U.S. alone.

- The substantial increase in dispersed facilities is creating a number of problems and opportunities for vendor maintenance operations.

  - Third party maintenance is often the only economically viable means of supplying maintenance to remote locations.

  - Spare parts stocking and distribution are critical.

  - Foresighted vendors can capitalize on the problem by providing spares distribution and maintenance services on a third party basis for non-competing vendors.

B. USER ATTITUDES TOWARD MAINTENANCE

1. USER INVOLVEMENT WITH MAINTENANCE

- The majority of users interviewed for the study were willing to participate in traditional vendor-supported maintenance functions providing they could see a pay-off in increased system availability.

  - Several large users maintain some of their own equipment today (e.g., Federal Express, SLAC). Usually the equipment for which they take responsibility is "simple"; for example, terminals and modems.

  - All sizes of users said they were willing to run vendor-supplied diagnostics and to participate in the execution of remote diagnostics.

  - Users of some equipment are doing board swaps from "high mortality" kits supplied by the vendor.

- Users said they were willing to install their own equipment if the procedure was not too complex. With the encouragement provided by IBM with the 8100 announcement, this will likely become an established trend with most new generation equipment.

- Users are, in general, willing to return devices to a local branch or repair depot for repair.

2. USER ATTITUDES TOWARD MAINTENANCE FEES

- The average user is not today particularly concerned with the cost of maintenance. His concerns are directed at system availability (i.e., uptime) and, in general, he is willing to pay more to achieve improved availability.

- Many users perceive (after the fact) that they have been oversold on preventive maintenance. Once this perception sets in, time and materials contracts are likely to displace fixed fee contracts.

- Most users feel that the level of service personnel is deteriorating. Where this perception is acute, the typical user believes he is being overcharged for what he is receiving.

3. USER ATTITUDES TOWARD MAINTENANCE ORGANIZATIONS

- Most users stated that they preferred the vendor's maintenance organization to report to marketing. This preference derives from a belief that pressure placed on marketing is more likely to bring results than the same pressure applied to other parts of a vendor organization.

  - IBM field engineering is in a separate division equal to marketing.

  - It doesn't really matter (to the user) where field service reports as long as both marketing and field service appear as a team with coincident objectives.

- Users tend to think in terms of the "levers" they can pull or pressure points they can push in order to get what they consider to be proper attention to their service problems.

  - Vendor-supplied maintenance on rented equipment provides maximum leverage.

  - Third party-supplied maintenance on purchased equipment provides the least leverage.

  - Vendor-supplied maintenance provides a definite competitive advantage over third party maintenance.

4. USER PERCEPTIONS OF THE FUTURE

- Users were not, in general, aware that maintenance problems were likely to become much more acute in the future or that maintenance costs would likely increase beyond what they consider to be acceptable bounds.

- Users tend to think that new equipment will be more reliable (true) while existing equipment will continue to run as it always has (unlikely). Vendors should plan to deal with the likelihood of increased customer dissatisfaction on a broad scale, especially in the 1980-1981 period.

C. MARKETING AND COMPETITIVE ISSUES

- Very few vendors recognize the utility of maintenance as a competitive tool. As noted earlier, users ranked reliability as the single most important criteria used in the evaluation process for equipment selection. IBM, of course, has set the standard and has proved that it can overcome large price gaps in competitive situations (where the competition has a clear cut price/performance advantage) by selling its maintenance/service capability.

- In particular, the specifications of the maintenance contract are frequently mishandled by salespeople and are often an item of confusion to the customer.

  - If the salesman senses that the prospect perceives that preventive maintenance (PM) is important, he will oversell its benefits and commit field service to more PM than necessary. This results in more expense to the customer and less available system time.

  - If the salesman senses that the prospect perceives little value to PM, he will undersell it with the result that the user will encounter more frequent unscheduled downtime than necessary.

- Selling inappropriate maintenance contracts usually costs the vendor money and, eventually, alienates the customer.

- Maintenance service has the potential to be a major contributor to vendor profits, at least in the short term. In the research for this study, INPUT found that few vendors pay proper attention to pricing nor do they carry out even rudimentary ROI analyses when it comes to maintenance.

  - Most vendors total their costs, add a profit/overhead factor, then ignore their own analysis and price within pennies of the competition (and 20-30% under IBM).

- As noted earlier, users are willing to pay for equipment availability. Premium pricing of maintenance services will be accepted if performance standards can be met.

- Although most vendors collect pricing data on competitors, very few track their competitor's actual performance. Thus, in addressing reliability as a competitive issue, vendors are poorly informed and are not able to use reliability/maintenance as an effective competitive issue.

- In this atmosphere, there are several actions vendors can take to use maintenance more effectively as a competitive tool and increase the profitability of the maintenance function.

  - Positive sales involvement by maintenance managers in the presale phase will help dispel prospect doubts regarding level and quality of maintenance services.

    - Managers involved in presales activity should receive sales training.

  - Field service should understand the availability needs of the customer and propose tailored maintenance programs to meet those needs.

Performance on each account should be monitored and adjusted as user needs change. Frequently, an opportunity to enlarge the scope of the maintenance contract or to save money on the performance side results.

- Competitive analysis departments should be chartered to include maintenance/reliability as an important subject to study.

- Vendors should establish better ground rules for the sale of maintenance services. In particular, marketing/sales should not be the "tail that wags the dog."

- Pricing schemes for maintenance service should ensure a reasonable profit. Maintenance should be viewed as a profit center by corporate management.

- Where a choice between using in-house and third party maintenance exists (within reasonable economic boundaries), go in-house.

- Most field service departments use several tools that should be more heavily promoted as sales aids because they can be equated to the prospect's perception of availabiltiy. These include such items as:

  . Central dispatch.

  . "Creative" stocking, distribution systems, and on-line locator files for spares.

  . Local branch office repair of returned boards.

  . Systems support/diagnostic centers.

  . Customer-operated diagnostic programs.

. "Fault-fix" data bases.

. Remote diagnostics.

D. SPARE PARTS

- All respondent vendors were concerned about the shortage of spare parts.

  - Users are experiencing lengthy mean time to repair cycles due to the lack of spare parts. Some of the user concerns can be attributed to inept field engineers who use this as an excuse.

  - Inventories represent a significant dollar investment yet are filled with older parts or costly seldom used items and are not balanced to usage.

  - The supply pipeline to repair and restock spares is usually too long to be really effective. Paperwork to handle the ins and outs of spares and their repair is expensive and slow.

  - Due to the use of "shotgun" diagnostics the supply pipeline typically contains up to 40% "no fault found" boards returned for repair.

- INPUT recommends that vendors:

  - Consider using on-site "high mortality kits" with possible user purchase involvement.

  - Review the present accounting method for spares inventory and establish realistic depreciation programs for seldom used and high dollar value items.

- Establish repair facilities for spare boards in local branch offices or create more regional repair centers as a means to shorten the spares pipeline.

- Establish an easy to use identification method and follow-up system to determine responsibility for "no fault found" boards returned for repair.

E. THIRD PARTY MAINTENANCE

- After several difficult years, third party maintenance firms have found a niche in the marketplace.

- Most users will not convert from vendor-supplied maintenance just to save money. Users will switch to get better service.

- As stated earlier, users prefer the hardware vendor to supply maintenance.

- Primary marketing opportunities exist for third party maintenance firms in:

  - Both vendor and end user markets for maintenance of electro-mechanical devices.

  - The end user market for distributed data processing.

  - The end user market by tailoring maintenance contracts and services to fit the user's needs.

  - Maintenance of older hardware where the vendor support commitment has been reduced or terminated.

- Third party maintenance firms will continue to grow through 1985 but will experience problems in attracting users of new generation hardware.

- Third party firms will not have access to the "fault and fix" files established by the vendors.

- Some hardware vendors have expressed a willingness to enter the third party maintenance business. INPUT believes that hardware vendors should not enter the third party maintenance business unless they have a surplus of field engineers or are opening new territories and would use maintenance of other equipment as a method of covering under-utilized personnel costs.

- Computer service companies that are providing on-site hardware and building a maintenance service function should consider maintaining equipment other than products currently sold by their organizations. This is recommended as an aid to more fully utilize field engineers during the early staffing phase and produce revenues to offset start up costs.

F. PERSONNEL ISSUES

- The most pressing problem facing most field service organizations today is finding, hiring, training, and retaining qualified field engineers:

    - Field service personnel are in short supply today. This situation will intensify, reaching a peak in the 1980/1981 time frame.

    - The industry is churning the same people and not training a sufficient number of new people to fill the supply-demand gap.

    - In the long term (post 1983), the personnel shortage situation will improve dramatically because technology will take up the slack.

- Traditional sources for trained technicians (i.e., the military) have virtually dried up and have not been replaced. Thus, vendors are competing for a limited number of qualified people.

- One vendor commented, "There are really only 500 good FEs in the country. At any one time they all work for the guy paying the most and he has the image of having a maintenance force."

- All field service organizations are virtually identical:

  - Most are run by ex-IBM people or are patterned after IBM.

  - Career paths are very much the same among vendors.

  - With few exceptions, FEs are looked upon as second-class citizens when compared with programmers and engineers.

- INPUT found that the average attrition rate of new hires in field engineering is 50%; i.e., companies must hire two people to net one.

  - Companies such as IBM and Hewlett-Packard, who have managed to create a professional image and environment for field service, have the lowest rate of attrition.

  - Much of the blame for high attrition rates can be placed on inept first line management.

- Most vendor's training programs are inadequate in the following areas:

  - They tend to rely on traditional training methods and are not state-of-the-art.

  - Training is not geared to the needs of the (relatively) less qualified people being hired today.

  - Older employees are not kept updated in the rapidly changing electronics field resulting in a tendency to obsolete people.

- Training is run by hardware-oriented technicians not qualified to integrate software training with hardware training.

- Some vendors are experimenting with incentive programs.

  - Most incentive programs look like marketing commission schemes. However, they don't appear to work well because it is difficult to establish and apply easily measurable standards, and the "judgement" factor plays too big a role in determining the amount of incentive compensation.

  - The incentive awards given to field service personnel are too small to have much impact.

- Most vendors have failed to set performance standards for field engineers. Goals, if established at all, are poorly monitored and only infrequently fed back to the individual. This is largely attributed to weak first line management.

- Vendors reported that 20% of field engineering time is spent on repeat and "no fault found" service calls. Very few vendors have formal programs that are designed to help minimize this unnecessary activity.

- INPUT believes that companies can do much to improve the personnel situation in general, improve productivity, and lower the attrition rate. Some recommendations:

  - Field engineering should manage its own recruiting and hiring functions. In many companies, the personnel department takes so long to get an offer out that many hiring opportunities are missed. Furthermore, the personnel department staff does not usually convey the initial professional/technical image sought by the candidate. First impressions are crucial.

- Vendors should consider establishing close ties with technical schools; e.g., funding courses geared to their needs, contributing instructors (who have a good image), arranging plant tours with graduating classes, etc.

- Programs should be instituted to improve the professional image of field service:

  . FEs should have visibility to senior management, both in and out of their department.

  . The field service organization should be equal to that of marketing and engineering.

  . Alternative career paths should be available permitting people to move not only within the field service organization, but also across organizational lines.

  . Senior corporate management should ensure that the importance of field service is conveyed to the entire corporation.

- A program for early identification of potential management talent should be instituted and followed by special handling and training of individuals so identified. People who are now "Peter-principled" into management must be given career alternatives.

- Although incentive compensation schemes have not worked well, vendors should continue to experiment. However, programs must have "teeth" and provide real incentives in order to motivate people.

- Management should institute more programs and systems aimed at improving utilization; i.e., establishing goals, monitoring progress against goals, and reporting results.

G. THE SOFTWARE MAINTENANCE ISSUE

- The issue of combining hardware and software maintenance is increasing in importance to all vendors providing systems to end users. Based on the research for this study, INPUT believes that by 1982, maintenance of vendor-supplied systems software by field service will be the rule rather than the exception.

  - The growth of distributed data processing is the principal driving force. As stated in a recent INPUT study, "Distributed Data Processing Systems: Applications, Performance, and Architecture," "...There is a close correlation between geographically dispersed organization structures and a predilection to adopt DDP methods..."

- It is not clear at this time, in a general sense, where the responsiblity for applications software maintenance will be placed.

- In the interviews for this study, INPUT found that most field service executives are reluctant to assume any responsibility for software maintenance.

  - They believe that software trained people will find greater opportunities as programmers - often outside their own companies.

  - They believe that they will have to pay programmer salaries which are higher today than those paid to FEs.

  - They feel that their present operations are taxed to the limit just dealing with hardware maintenance, and they cannot handle the added responsibility for software.

- Although the issue of software maintenance did not receive extensive treatment in this study (by design), INPUT believes that surviving successful vendors, especially those involved with DDP, will offer integrated hardware/software maintenance. Therefore, INPUT strongly recommends that vendors immediately institute plans to obtain people, establish training programs, and develop supporting corporate policies aimed at creating an integrated capability. The plan should be implemented no later than the end of 1979.

III BACKGROUND AND PRESENT STATUS OF THE INFORMATION PROCESSING EQUIPMENT MAINTENANCE FUNCTION

III BACKGROUND AND PRESENT STATUS OF THE INFORMATION PROCESSING EQUIPMENT MAINTENANCE FUNCTION

A. THE EVOLUTION OF MAINTENANCE IN THE INFORMATION PROCESSING INDUSTRY

- Traditionally, a buyer expects his purchase of a product to include service warrantees, repairs, or guarantees. The information processing industry conforms to these practices. In fact, this industry is one of the most demanding and competitive in relation to customer satisfaction and product maintenance and service.

- Initially, product maintenance in the information processing industry was provided as a service intended to be no more than an extension of the product sale.

- When leasing a system or product, the maintenance cost was included in the monthly rental price of the equipment. Since it was never separated as a price item, the user became used to considering maintenance as part of the sale.

- In 1956, IBM entered into a consent decree with the Federal Government and became obligated to sell as well as rent equipment. IBM was forced to publish individual prices for spares, training of personnel, and maintenance required to repair equipment.

- This resulted in major changes in the packaging and delivery of maintenance services; however, at the time it appeared to be of minor impact.

- The installed equipment base in the late fifties consisted primarily of unit record equipment. Few new competitors were attracted to the industry due to the substantial investment required for tooling, manpower and inventory.

- Extended commitment and pay-out periods made the purchase of information processing equipment unattractive to the majority of potential users.

- In the mid-1960s, IBM, to meet the customer and product demands of S/360, reorganized field engineering and formed a separate division with profit and loss responsibilities.

- The industry viewed this IBM reorganization as merely a rearrangement of "a mass" represented by the huge group of personnel operating within marketing and field engineering as one division. At that time this was a reasonable analysis; however, it became apparent during the recession of the early 1970s that a separate field engineering division permitted not only improved cost control, but the means for creating a profit center. With the decline in sale and lease revenues, field maintenance cost control became a matter of survival for many companies in the industry.

- During the past five years, many vendors have reorganized field engineering function:

  - As a cost center within marketing and operations.

  - As a separate division with profit responsibility.

- As a separate group reporting to a manager having responsibility for production, marketing, and engineering.

- Field engineering's status as a division with profit and loss responsibility has evolved because:

  - Of an increasingly competitive marketplace with maintenance becoming a key factor in vendor selection.

  - With increasing competition in the industry, improved cost control is required with all operations and functions contributing to corporate profit.

  - Revenue derived from product maintenance is increasing as a proportion of total corporate sales, thus, providing a greater impact on profits.

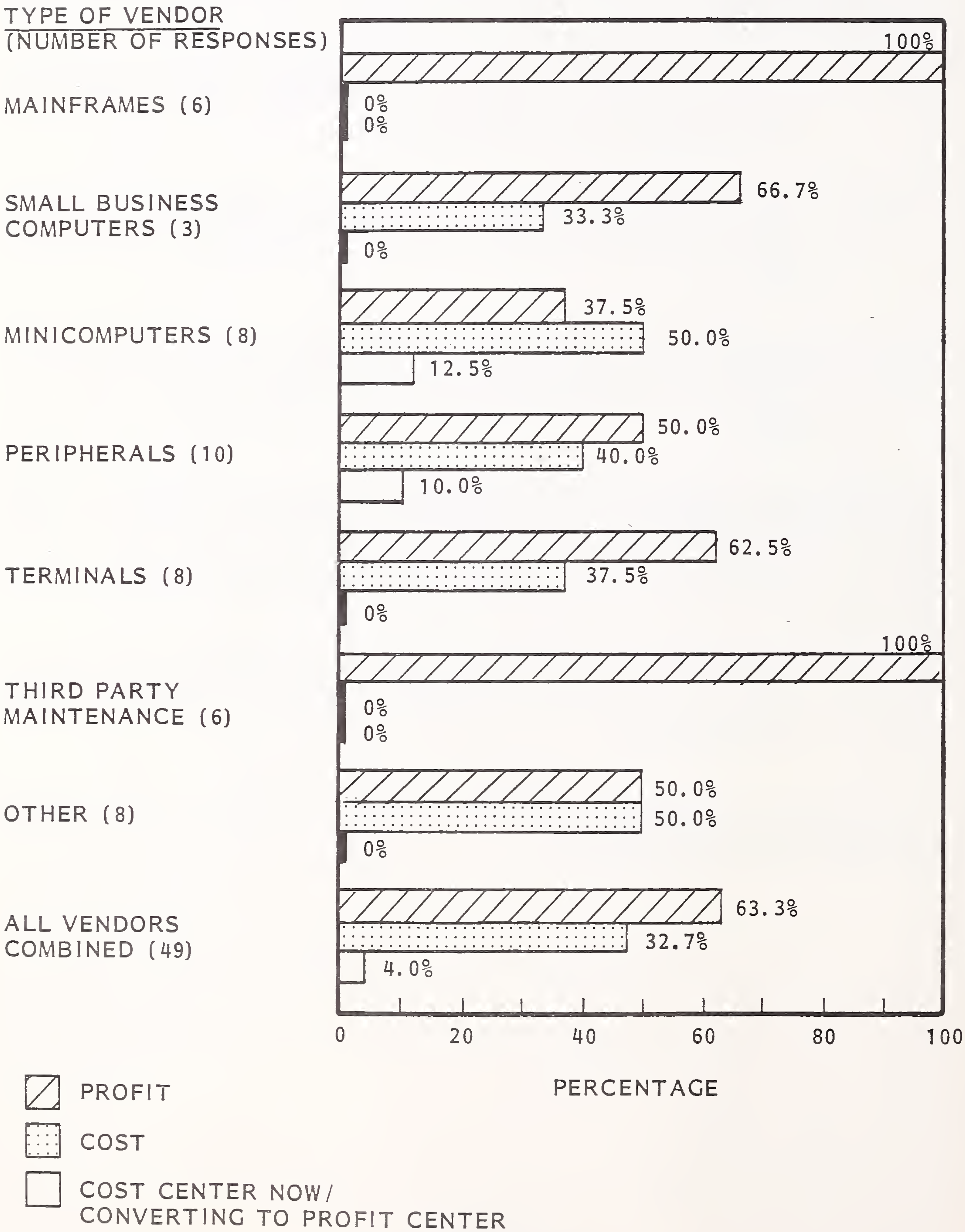
  - Field engineering is labor intensive and these hourly rates are rising more rapidly than other costs, increasing the requirement to focus management attention and action in the area of maintenance.

  - As performed by other functions within the corporation, maintenance represents an investment of capital and should be measured by a return on this investment.

- The growing frequency of corporations organizing maintenance as a profit center is shown in Exhibit III-1.

EXHIBIT III-1

CLASSIFICATION OF MAINTENANCE OPERATIONS AS PROFIT GENERATORS OR COST CENTERS BY RESPONDENT VENDORS



B. MAINTENANCE IS A KEY FACTOR IN THE EVALUATION AND SELECTION OF AN EQUIPMENT VENDOR

- In conducting numerous studies involving minicomputers, large mainframe systems, communications networks, and other equipment and services markets, INPUT determined that user establishments, both large and small, overwhelmingly considered product reliability and vendor maintenance capability to be of prime importance. These two factors consistently were more highly rated by user respondents than other considerations such as price/performance, product design, financial arrangements, training, vendor image/reputation, and product delivery. Following are five examples of recently conducted research studies which emphasize the importance of the maintenance function as viewed by the user.

1. SERIES/1 MINICOMPUTER SYSTEM

- In July 1977, INPUT conducted a multiclient study on IBM's Series/1 minicomputer system. Approximately 40 of the first 120 Series/1 users were interviewed to determine the product's strengths and weaknesses.

- As shown in Exhibit III-2, respondent users reported they believed IBM maintenance and support to be the greatest product strength of the Series/1 (58%), providing the ability to service and maintain this equipment in remote locations.

2. SMALL ESTABLISHMENT MANUFACTURERS

- In conducting a survey of small establishment metalworking manufacturers, INPUT determined that when evaluating a product for purchase, an overwhelmingly large percentage of those being interviewed believed that product reliability and field maintenance were the factors of highest importance (Exhibit III-3), compared to product delivery or user training.

EXHIBIT III-2

RESPONDENT ATTITUDES TOWARDS
SERIES/1 PRODUCT STRENGTHS

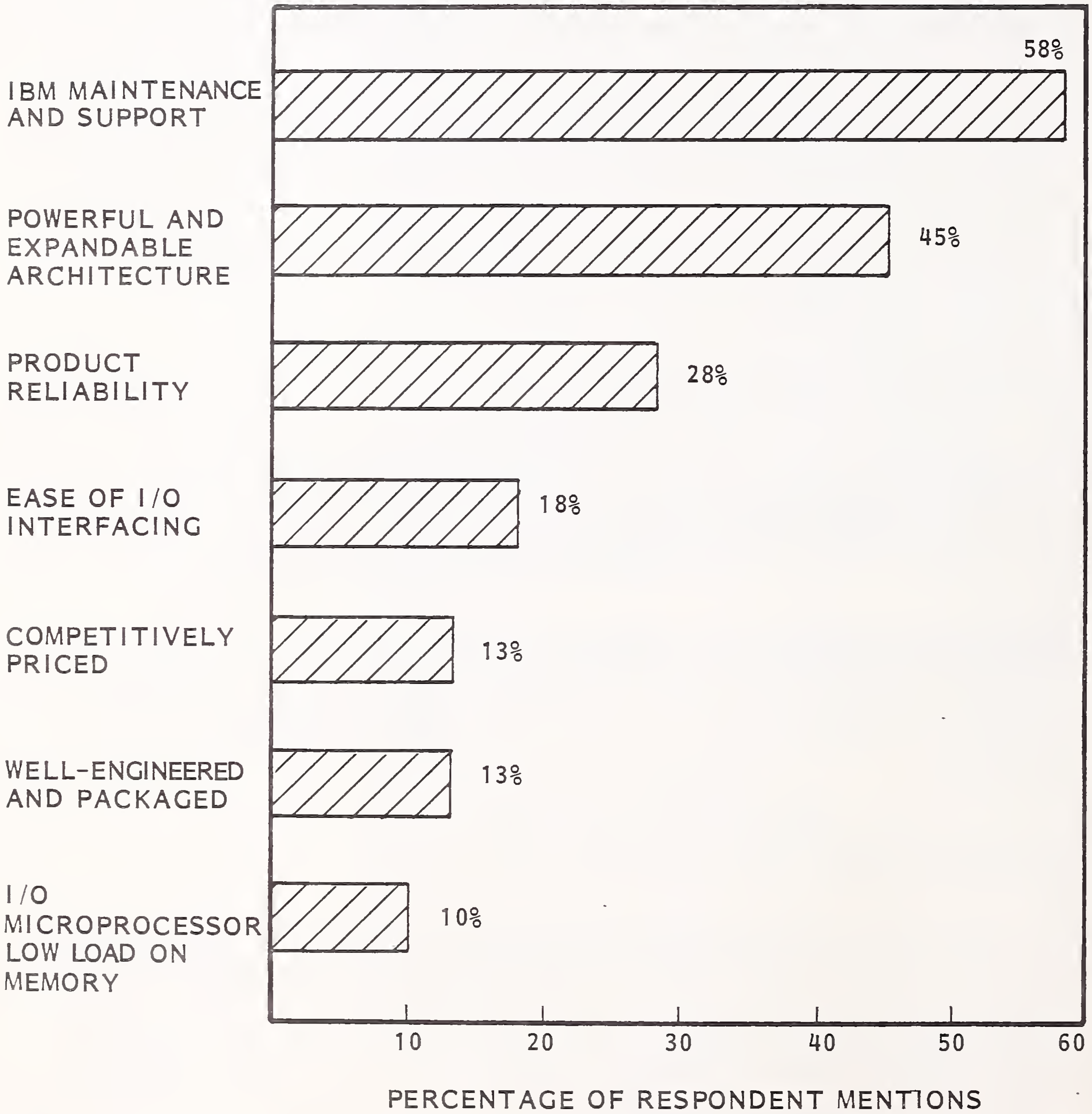
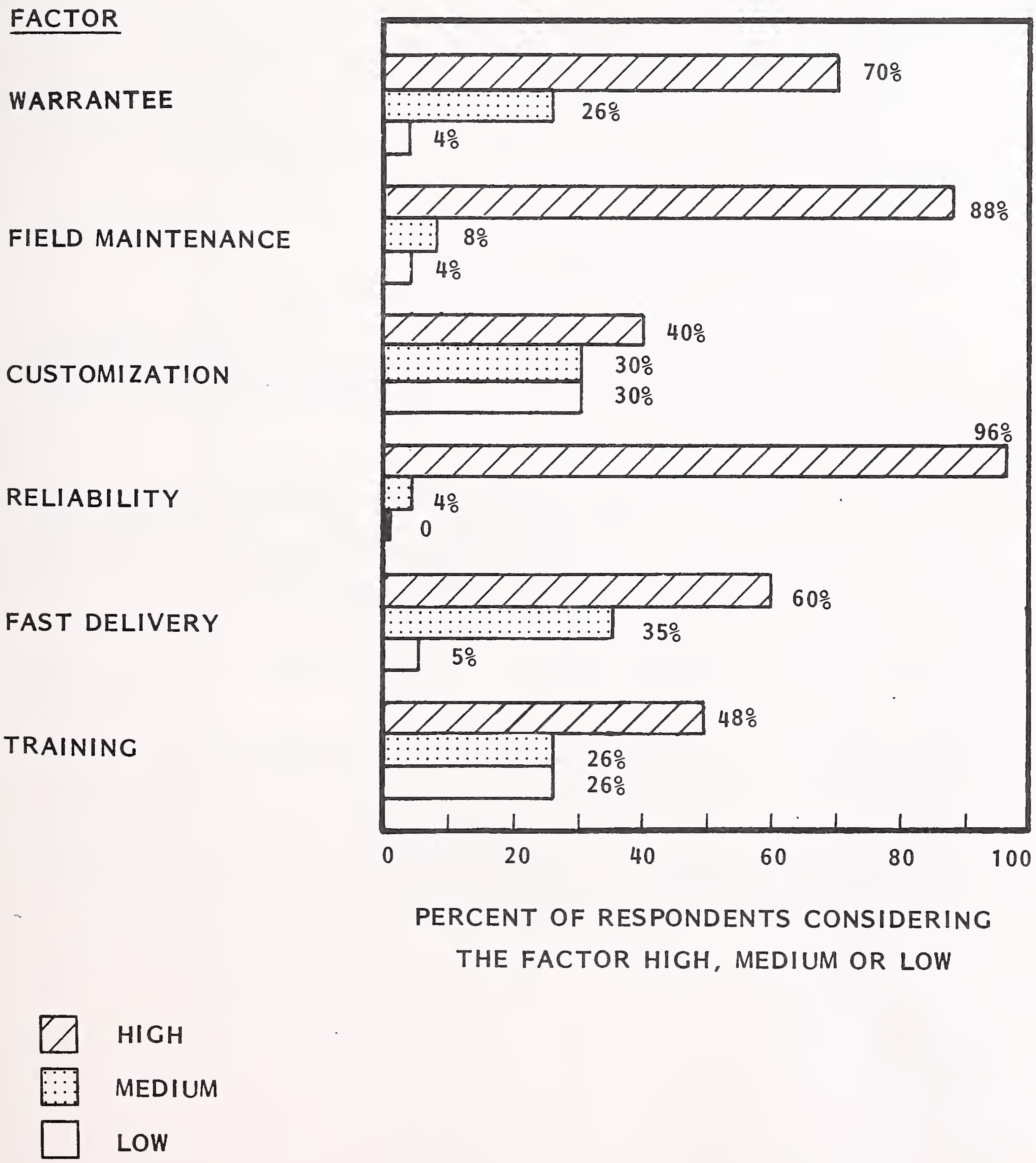


EXHIBIT III-3

SMALL ESTABLISHMENT MANUFACTURERS
(METALWORKING): RESPONDENT
ATTITUDES TOWARDS IMPORTANCE
OF FACTORS IN PURCHASING DECISIONS



3. IBM PLUG COMPATIBLE MAINFRAMES

- Over 100 interviews were conducted by INPUT to determine ratings of factors considered by respondents in the selection of a plug compatible mainframe vendor.

- The highest scores (93 of a possible 100) were attributed to product reliability and maintenance capability, which ranked higher than other factors usually considered to be of great importance such as sales contacts and financial arrangements, each of which rated a score of less than 50 (see Exhibit III-4) by comparison.

4. DISTRIBUTED DATA PROCESSING

- INPUT conducted over 100 in-depth interviews of major U.S. corporations during 1978 to determine user attitudes concerning the installation of distributed data processing.

- Exhibit III-5 shows that product reliability and maintenance capability were rated "critically important" by 95% and 82% of the respondents, respectively. These were the <u>only</u> factors reporting no ratings of "unimportant."

5. VALUE ADDED NETWORKS (VAN)

- Over 150 major U.S. corporations either using or considering the use of VAN services were interviewed by INPUT in 1977 as part of a multiclient study on network services. Respondents reported highest interest in the factors of maintainability (77.8%), and fault diagnosis (67.3%) when compared with other key factors such as network design or training (Exhibiti III-6).

EXHIBIT III-4

RESPONDENTS' RATINGS OF FACTORS WHEN EVALUATING AN IBM PLUG COMPATIBLE MAINFRAME (100 MAXIMUM)

FACTOR	TOTAL RATINGS
PRODUCT RELIABILITY	93
MAINTENANCE CAPABILITY	93
SOFTWARE SUPPORT	85
PRICE/ PERFORMANCE	75
FIELD UPGRADABILITY	75
VENDOR IMAGE/ REPUTATION	68
VENDOR SALESMAN CONTACTS	50
SINGLE VENDOR FOR ALL PURCHASES	48
FINANCIAL ARRANGEMENTS	48

EXHIBIT III-5

RESPONDENTS' RATING OF FACTORS WHEN CONSIDERING INSTALLING DISTRIBUTED DATA PROCESSING

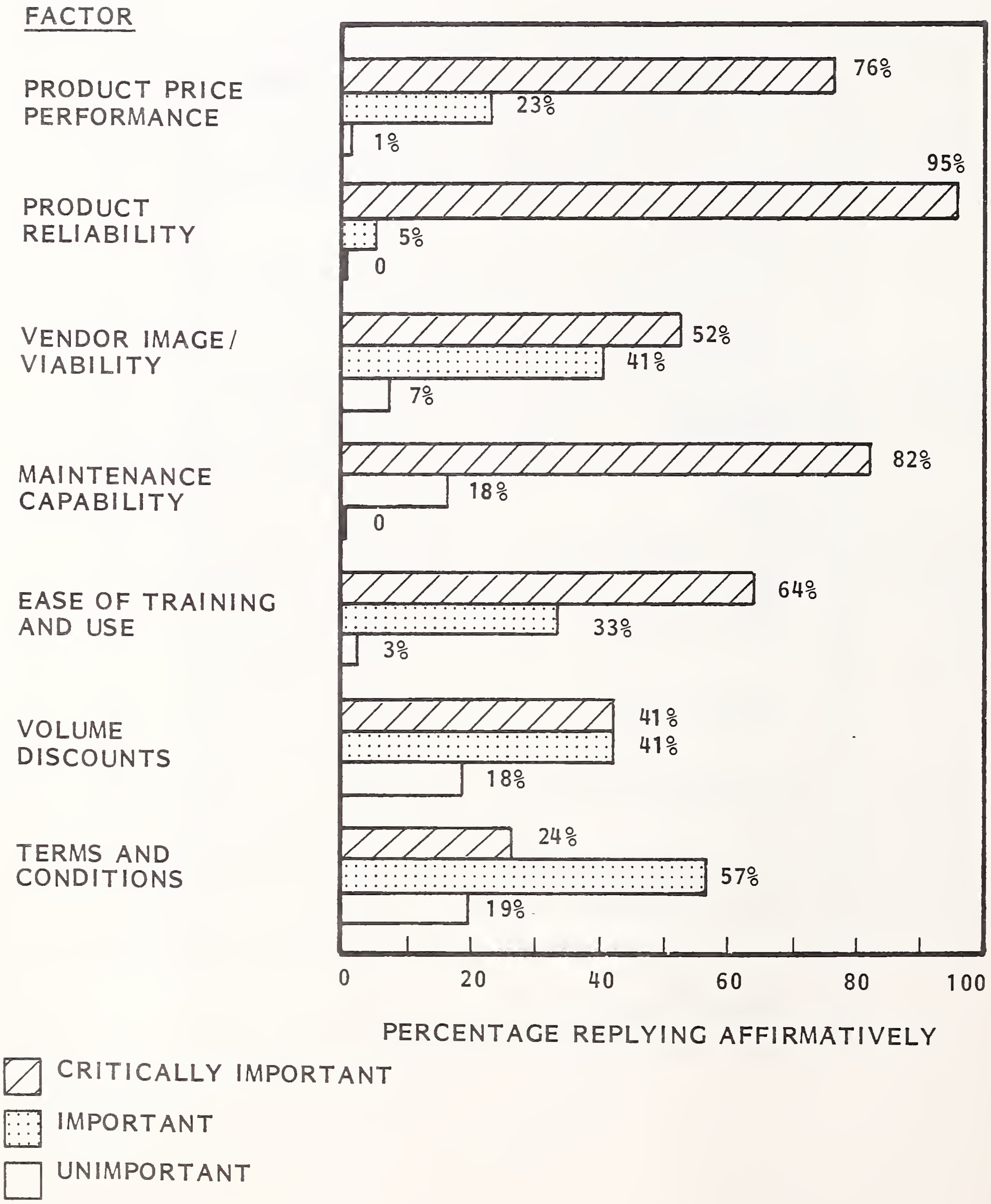
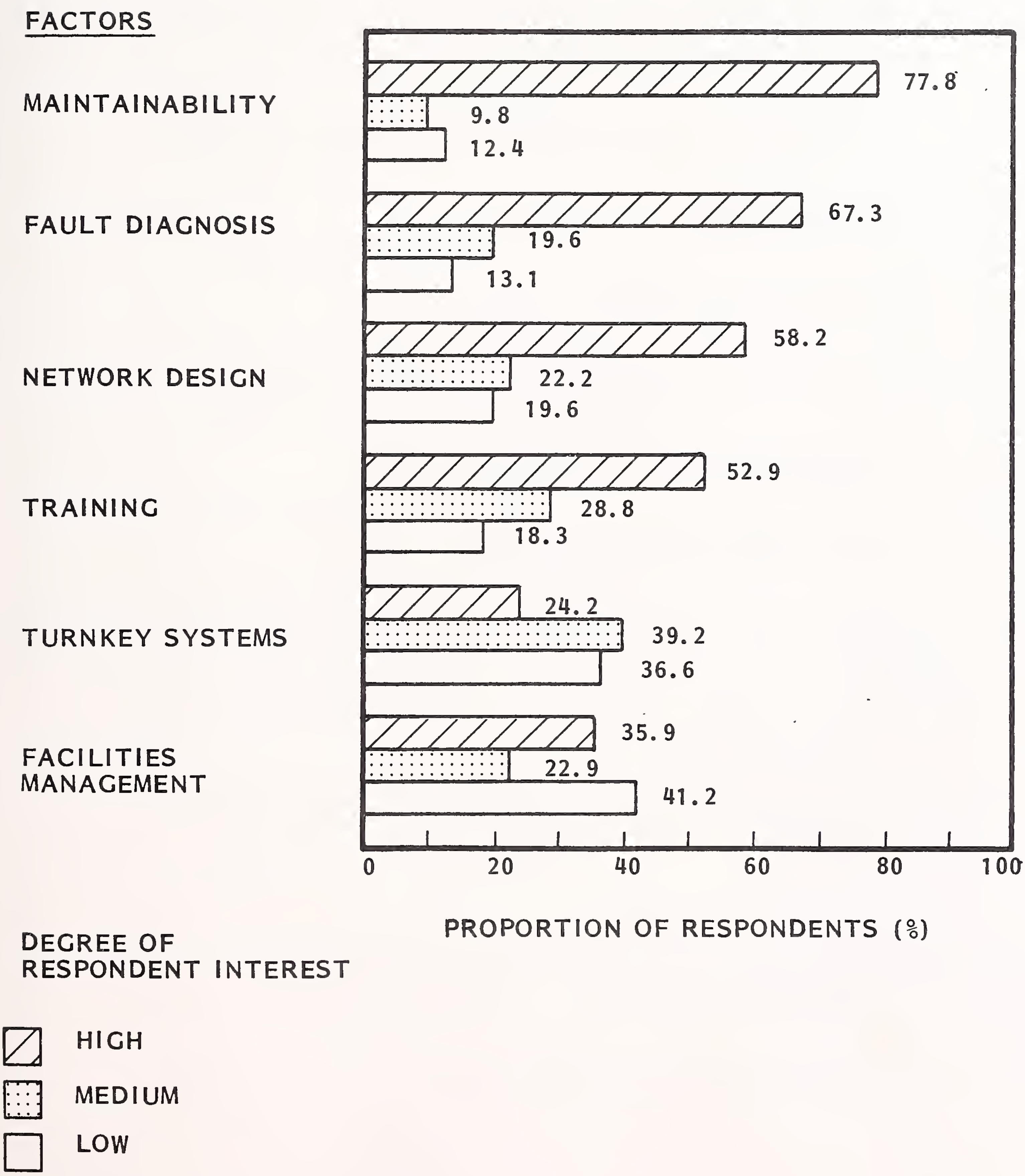


EXHIBIT III-6

VALUE ADDED NETWORK SUPPORT SERVICES
WANTED BY ALL COMPANIES



C. THE ORGANIZATIONAL STRUCTURE OF MAINTENANCE

- As the importance of maintenance has increased in ranking by the end user, so has the internal company structure of maintenance been elevated.

- The senior maintenance executive's position is now Vice President (or equal) in nearly all of the respondent vendors' corporate organizations. Titles include:

  - Vice President of Field Engineering (or Customer Service).

  - Vice President.

  - Senior Vice President.

  - Director of Field Engineering (or Customer Service).

  - President of the Field Engineering Division.

  - Vice President and General Manager.

- Functions usually reporting to the senior corporate maintenance executive include:

  - Line field service.

  - Logistics.

  - Maintenance training.

  - Plant field engineering.

  - Maintainability and planning function.

- Spare part repair depots.

- Dispatch.

- Technical support groups.

- Functions occasionally reporting to the senior maintenance executive include:

  - Systems software maintenance.

  - Sales order entry.

  - Plant scheduling.

  - Manufacturing quality assurance.

  - Application software system engineers.

  - Field engineering recruiters.

  - Maintenance and supplies marketing.

- The above organizational changes are occurring as maintenance evolves in the corporate environment. Other restructuring of responsibilities include:

  - Systems software maintenance is projected to become a part of field engineering by 1982 by most respondent vendors who supply this service.

    . Both systems software maintenance and hardware maintenance are labor intensive.

- The delineation between the product's requirements for software and hardware maintenance is increasingly difficult to establish due to complex systems configurations.

- Field engineering has assumed some software maintenance responsibility when responding to service calls and performing checks proving that the hardware is properly operating.

- Sales order entry will more often involve field engineering as order scheduling and customers' installations must coincide with field engineering availability within a geographic location. A personnel shortage for maintaining equipment could restrict product installations and company growth in the 1980 and 1981 time frame.

- Manufacturing scheduling requires field engineering input for establishing the mix of new build for customer orders and spare parts for repair. Every vendor interviewed expressed a need for more spares and many users stated that a larger spares inventory was required to improve service and reduce mean time to repair.

- Manufacturing quality assurance impacts field engineering labor expenditures. Units shipped from the factory should perform to specification in the customer's location. Marginal units should be repaired at the factory where the required material and personnel are available as opposed to "patching" on the customer site by personnel who frequently lack parts and testing equipment.

- Maintenance of application programs and the required system engineering force should become part of the field engineering function. The slogan "one problem, one call, one man, one fix" will become an increasingly stronger requirement in the industry, especially with the advent of distributed data processing (DDP).

- DDP places powerful and inexpensive computers in the hands of relatively untrained user personnel and will create a strain for even the largest and most efficient field engineering force.

- Other problems may influence the maintenance of applications programs by field engineering, such as one vendor comment: "If it worked yesterday and doesn't today, is it a field engineering problem or a marketing problem?"

- As the supply of qualified maintenance personnel decreases as the demand increases, field engineering must play a more active role in the hiring procedure (e.g., the addition of field engineering recruiters to augment local office and personnel department efforts).

- Field engineering, as a profit center, should add personnel to fulfill the marketing requirements involving maintenance services and supplies.

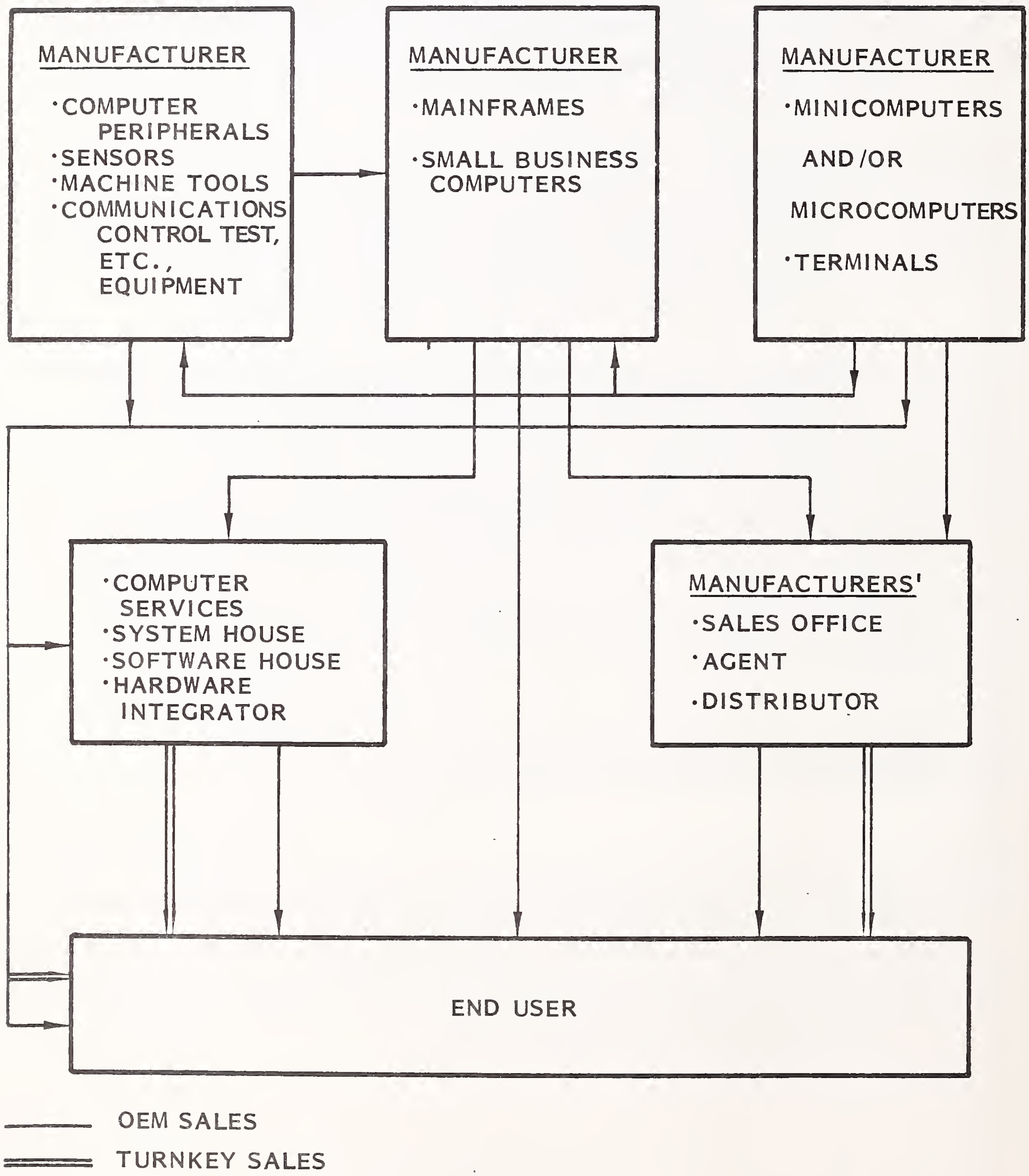
- The maintenance function has evolved from being "a necessary evil" to becoming an integral part of the corporate team. Also, the importance of service is increasing as it is becoming the criterion upon which the user selection process is often focused and has therefore become a key element in the vendors' marketing plans and strategies.

D. VENDORS OF MAINTENANCE SERVICES

- Exhibit III-7 illustrates the complexity of the product distribution function within the information processing industry. One of the primary considerations of a company when expanding or evaluating the change from being an OEM supplier to an end user orientation is the factor of providing a responsive maintenance service to the equipment user.

EXHIBIT III-7

METHODS OF PRODUCT DISTRIBUTION



- The end user maintenance responsibility is substantially more demanding than providing OEM support. This function is often subcontracted to distribution or third party organizations by the manufacturing company.

- Maintenance services for the end user are provided by one of the following:

1. EQUIPMENT MANUFACTURERS

- All large mainframe, small business computer, minicomputer, peripheral, and terminal manufacturers provide maintenance services to users purchasing the product directly.

- Manufacturers do not in all cases offer maintenance coverage to users purchasing equipment through a distributor, systems integrator, software house, etc.

2. OTHER DISTRIBUTORS OF SYSTEMS

- A distributor of systems must usually be prepared to maintain the product he sells to his customer for the following reasons:

  - The manufacturer may not offer adequate maintenance services in his required geographic area.

  - By his establishing an increasingly greater product installation density, the distributor can create a growing source of recurring revenue.

  - Good local product maintenance provides visibility to the user of a capable product vendor.

3. COMPUTER SERVICES COMPANIES

- Computer services companies have entered the turnkey systems marketplace by supplying applications or systems software and telecommunications capability as an added value to a hardware system purchased from the manufacturer.

- As with the system distributors, the computer services company can develop a new growth source of revenue by offering product maintenance to its customers.

4. THIRD PARTY MAINTENANCE ORGANIZATIONS

- End users may select a third party organization to perform system maintenance on their purchased equipment for one of the following reasons:

  - Dissatisfaction with the service offered by the system distributor or manufacturer.

  - The third party organization's capability of providing the strongest maintenance support in a particular geographic area.

  - The third party organization is often able to provide the user a savings in maintenance cost compared to the system distributor or manufacturer.

  - Third party can provide a one vendor maintenance service for a multi-vendor installation.

5. RETAILERS

- The retail store has recently developed as an outlet for computer goods and maintenance services.

- These outlets are currently selling at a rate of about 200,000 home or hobby computers annually with 20% entering the small business market.

- Established computer manufacturers are cautious in their consideration of entering the retail business market.

  - Retail stores may be the key that unlocks the burgeoning small business market.

  - The cost of merchandising through retail outlets is substantially less than through the traditional direct salesman approach.

- Most retailers are offering maintenance service for the products they vend.

  - Since retailing in the computer industry is in its infancy and the user base is small, considerable experimentation can be expected before a "standard" method of delivering maintenance services evolves.

E. TECHNIQUES PRESENTLY USED FOR PROVIDING MAINTENANCE SERVICE

- Field service for information processing equipment is currently being provided in much the same manner as in the past several years.

  - Trouble calls are placed with a local dispatch telephone number and passed to the field engineer for response. The field engineer maintains his inventory "call queue" and ranks the servicing sequence.

  - Large accounts are serviced by on-site field engineers who report to the customer location for designated shifts.

- Due to increasing labor costs, techniques for providing maintenance service are slowly being modified. Some recent incorporated changes and new techniques include:

    - Central dispatch: User problem calls are answered by a nationwide or regional dispatch center. "Call queues" are maintained on a computer system.

    - System support centers: Provides technical support for hardware and software and responds to either end user or field engineer inquiries.

    - Radio dispatch: Maintains radio communications with field engineers. Field engineers may spend up to 50% of their working time in auto travel and are unreachable during this period.

    - Remote diagnostics: With the utilization of communications facilities and on-line computers it is possible to perform fault isolation tests remotely. If a service call is required, the field engineer is dispatched to the machine site.

    - Customer operated diagnostics: Vendors are providing software programs that will allow the user to test the system for accuracy. Although such test programs may not isolate faults, they will determine if the problem is in the hardware or the application program.

    - End users performing board swap: Utilization of local and remote diagnostics and training can create an environment whereby the end user replaces faulty boards with an on-site spare.

    - For smaller devices having quantity installations at a single location (e.g., POS, modems, hand held wands, terminals, etc.), a variety of programs are in effect to eliminate service calls. Some examples are:

1) Mailing the defective unit to a repair depot or plant.

2) Delivering the product to the local branch or repair depot.

3) Accumulating a number of faulty devices for scheduled periodic on-site service calls.

- Field engineers are instructing end users on the performance of preventive maintenance for certain simple electro-mechanical devices. Although operator care of equipment is customary, the complexity of user involvement is increasing.

- End users are encouraged to install their equipment. A large vendor who formerly tagged the shipping carton with "Do not open. Warranty will be voided," in a recent announcement of a new computer stated "...the user is encouraged to install this equipment. It is as easy as hooking up a stereo sound system."

- In the future, end users are expected to be more involved with maintenance by:

  - Cooperating on testing and running diagnostics prior to placing a service call.

  - Assisting in peforming remote diagnostics.

  - Self-installation of smaller devices and systems.

  - Purchasing and stocking needed on-site spares and board swapping.

  - Performing a higher level of preventive maintenance.

F. DRIVING FORCES

- INPUT forecasts a variety of factors that will impact the maintenance function for the information processing equipment industry over the next five years, and also offer a number of new business opportunities. These driving forces run the gamut from product price/peformance improvements to inflationary factors forcing labor costs to increase.

- Increasing labor costs and the shortage of qualified personnel are causing serious problems for management in the labor intensive service business.

  - Salaries within the information processing industry as a whole are rising; e.g., 12.4% average in the last year.

  - Salaries for field engineers are increasing even more rapidly: 16-18% annual rate.

- End users are buying new equipment at an accelerated rate, and the availability of personnel to repair this hardware is not increasing as rapidly as the shipment rate.

- Demand for equipment to be utilized in an expanded geographic area, through the use of distributed data processing, will require faster growth of the field engineering force.

- In maintaining products within an expanded geographic area, organizations will be competing for the same finite supply of available field engineering talent.

- Technical innovations, such as the microprocessor, value added networks and multi-function equipment will create additional demands for new hardware and increased maintenance service.

- Few vendors interviewed for this survey are staffed with a balanced mix of required personnel skills.

  - One vendor employs an over-abundance of electro-mechanical skills who are being retrained for electronics, while another firm is seeking electro-mechanical personnel to support its installed base.

  - Some vendors are in short supply of personnel to maintain equipment while others with a field engineering force lack an installed base to utilize this asset.

  - All vendors require software support personnel and have open job requisitions to be filled.

- New business opportunities exist in:

  - Providing a responsive and effective single source for maintenance service for multi-vendor installations.

  - Establishing trade schools for technical hardware and software training.

  - Establishing a third party service company for electro-mechanical products.

  - Utilizing excess field engineering manpower in maintaining equipment manufactured by others.

  - Providing service for computer stores to utilize excess field engineering manpower.

  - Small software firms maintaining user and vendor supplied software under contract to the vendor, particularly in remote areas.

IV RESULTS OF THE INFORMATION PROCESSING INDUSTRY USER SURVEY

IV RESULTS OF THE INFORMATION PROCESSING INDUSTRY USER SURVEY

A. BUDGETED USER EXPENDITURES FOR EDP AND MAINTENANCE

- The 145 respondent users reported 1978 information processing expenses of $302 million. Twenty-seven large and very large respondents reported expenses of $283 million or 86% of the total (see Exhibit IV-1) (Note: respondent user budgets include hardware, software, maintenance, data communications, salaries and exclude supplies, facilities rental, utilities, travel and training.)

- The users projected expenditures for information processing of $381 million for 1980 and $505 million by 1983 (see Exhibit IV-2). This represents a 15% increase in expenditures in 1979 and 10.8% in 1983 (Exhibit IV-3).

- For the period of 1979 through 1983 respondent manufacturing and distribution firms reported the largest increase of information processing expenditures for any industry group (see Exhibit IV-4) and also the largest rate of projected growth, 17.9% AAGR. The lowest growth rate (8.1%) being for all government groups.

- Users stated 4.8% of their information processing expense budget in 1978 was for maintenance. Maintenance expenses amounted to $14.4 million for 1978, $19.4 million projected for 1980 and $25.4 million for 1983, representing an AAGR of 12.0% (see Exhibit IV-5). This compares to:

EXHIBIT IV-1

RESPONDENT USER EXPENDITURES FOR INFORMATION PROCESSING GOODS AND SERVICES BY COMPANY SIZE
1978

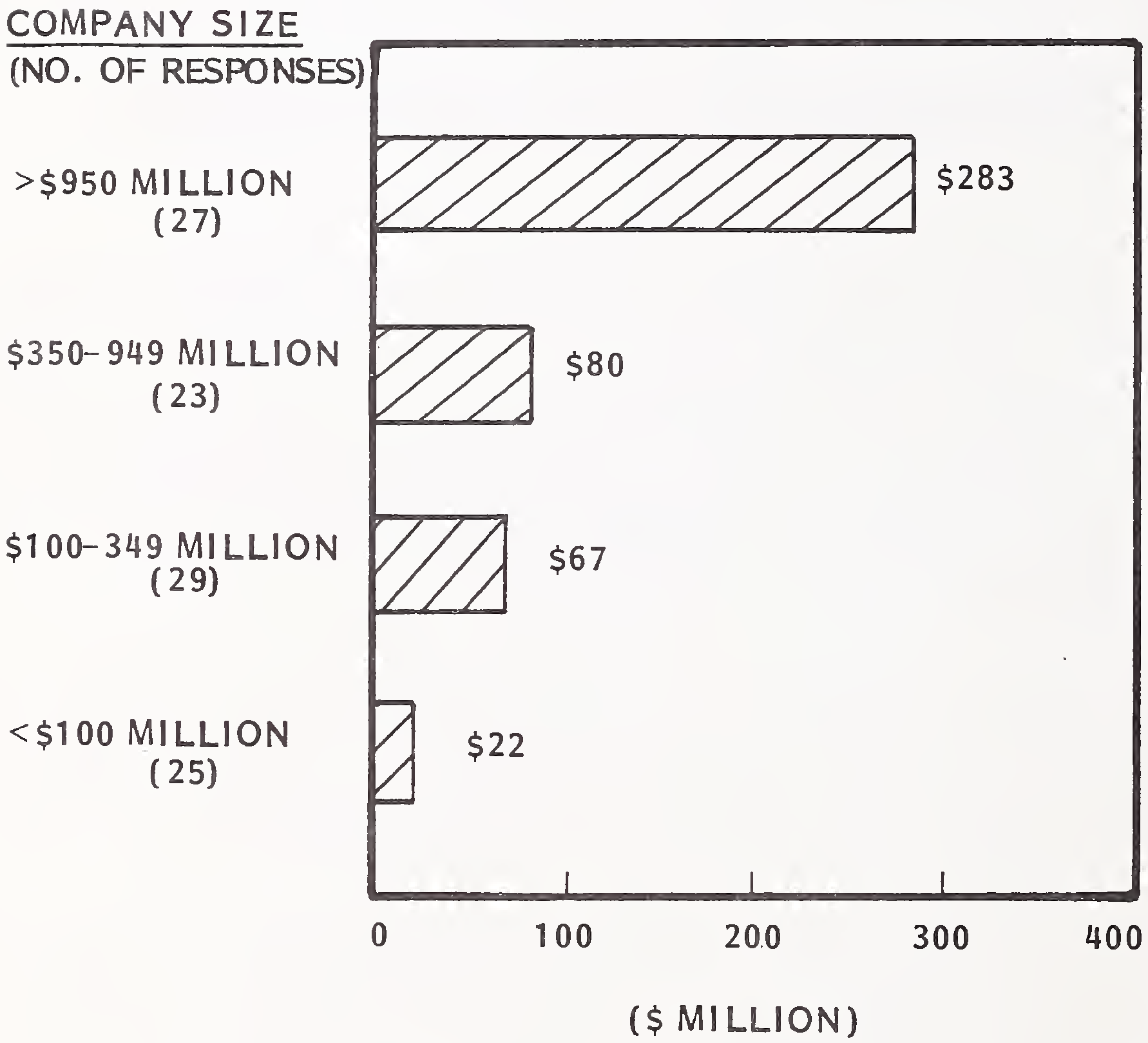
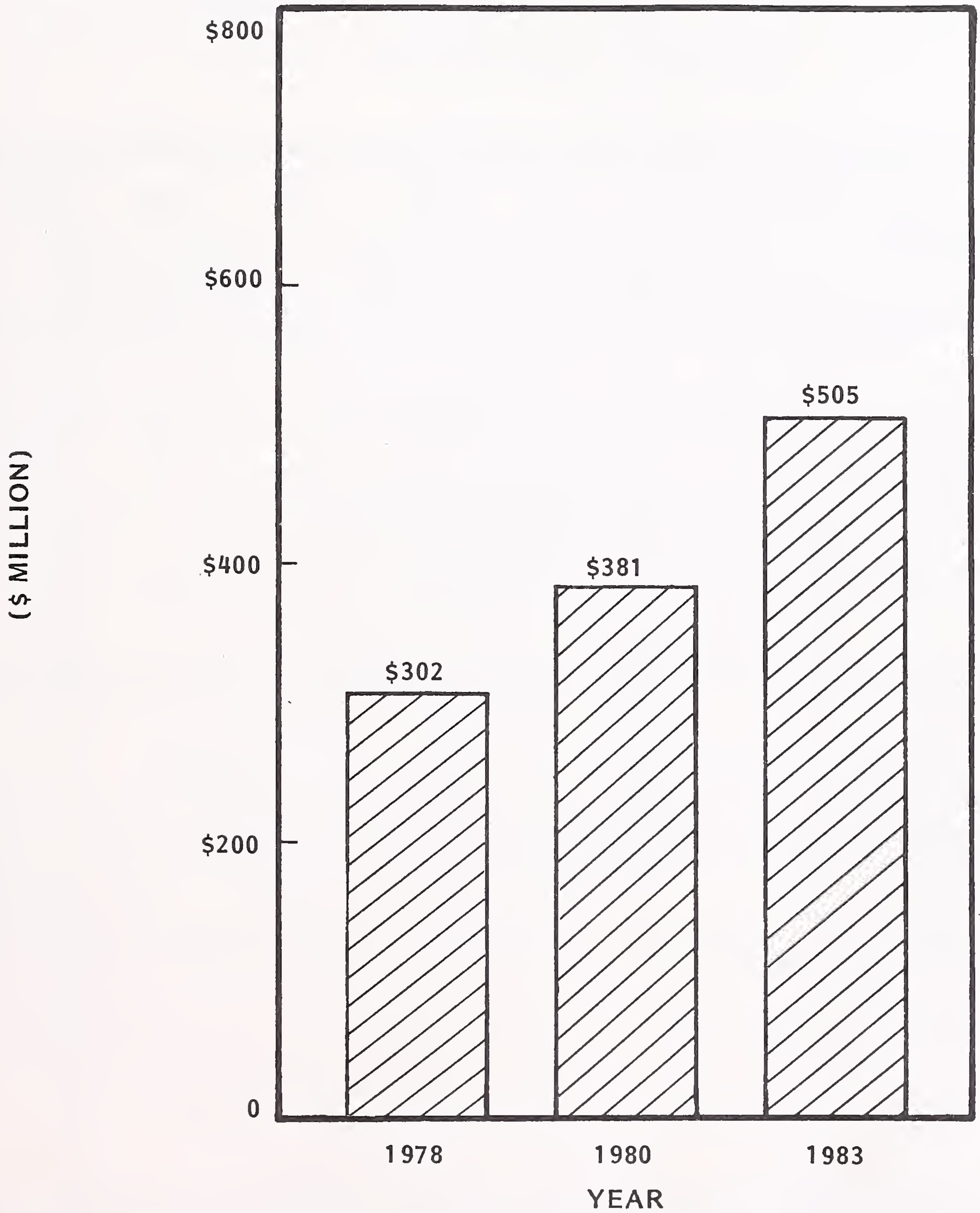


EXHIBIT IV-2

RESPONDENT USERS' PROJECTED
INFORMATION PROCESSING
EXPENDITURES - 1978-1983



NUMBER OF RESPONSES-81

EXHIBIT IV-3

ANNUAL PERCENT INCREASE OF RESPONDENT USER EXPENDITURES FOR INFORMATION PROCESSING AND SERVICES BY COMPANY SIZE: 1979-1983

COMPANY SIZE	1979	1980	1981	1982	1983
>$950 MILLION	14.4%	12.2%	11.4%	11.4%	11.6%
$350-$949 MILLION	13.0	12.0	11.5	11.3	11.3
$100-$349 MILLION	18.4	11.5	9.0	8.6	8.4
<$100 MILLION	15.9	13.4	12.8	12.3	12.1
AVERAGE	15.4%	12.3%	11.2%	10.9%	10.8%

EXHIBIT IV-4

DISTRIBUTION OF INFORMATION PROCESSING EXPENSES
BY INDUSTRY SECTOR, AS FORECASTED
BY RESPONDENTS, 1978-1983

INDUSTRY SECTOR	1978 ($ MILLION)	1980 ($ MILLION)	1983 ($ MILLION)	AAGR (1978/1983) (%)
MANUFACTURING AND DISTRIBUTION	$167.60	$231.20	$381.50	17.9%
BANKING AND FINANCE	66.70	84.23	110.70	10.6
UTILITIES	69.33	85.29	118.56	11.3
FEDERAL, STATE AND LOCAL GOVERNMENT	14.60	17.20	21.60	8.1
OTHER	12.02	16.00	22.60	13.5
TOTAL	$330.24	$433.92	$654.96	14.7%

NUMBER OF RESPONSES-81

EXHIBIT IV-5

DISTRIBUTION OF INFORMATION PROCESSING EXPENSES, BY EXPENSE CLASSIFICATION, AS FORECASTED BY RESPONDENTS (1978 - 1983)

CLASSIFICATION	1978	1980	1983	AAGR
MEDIUM/LARGE SYSTEMS AND MINI/SMALL BUSINESS COMPUTERS	$ 97.3	$ 120.8	$ 166.0	11.3%
TERMINALS	11.1	14.2	17.9	10.0
DATA COMMUNICATIONS	27.4	34.9	49.2	12.4
PERSONNEL	152.4	191.5	246.7	10.1
MAINTENANCE	14.4	19.4	25.4	12.0
TOTAL	$ 302.6	$ 380.8	$ 505.2	10.8%

- Users reporting the lowest expense growth during this period for personnel (AAGR of 10%).

- Data comunications cost increase of 13% AAGR, represents the highest expense growth for the 1978-1983 time period.

- The average reported by respondent users of only 12.4% AAGR for maintenance expenses are based upon the following observations.

  - Users are not attuned to the pending increases in maintenance costs.

  - Users are planning a 13% AAGR increase in expenditures for data communications equipment. (Note: the survey results include costs related to communications carrier services as they are reflected in the data center budget; i.e., line charges and physical on-site equipment provided by the common carriers.)

  - Users project a modest AAGR increase of 14.4% for personnel. However, the effective rate of increase is much higher due to personnel dispersement for applications as on-line data entry and the growth of distributed data processing. This distribution of personnel will slow the rate of growth for the data processing department expense budget since these people will appear on the budgets of other departments.

- Medium size companies ($101-349 million in sales or equivalent) reported a 25% AAGR, the largest increase in information processing expenses of the company size classification (see Exhibit IV-6).

  - The growth in medium size companies expenditures for information processing relates to reduced prices for hardware allowing firms in this size range to automate applications requiring larger mainframes with more memory and disks than they could afford in the past.

EXHIBIT IV-6

AVERAGE INFORMATION PROCESSING
EXPENDITURES BY COMPANY SIZE
AS FORECASTED BY
RESPONDENT USERS

COMPANY SIZE	1978 ($ MILLION)	1980 ($ MILLION)	1983 ($ MILLION)	AAGR (1978-1983) PERCENT
VERY LARGE >$950 MILLION	$8.89	$12.33	$21.42	19.2%
LARGE $350-949 MILLION	3.50	4.04	5.56	9.7
MEDIUM $100-349 MILLION	2.32	2.94	7.08	25.0
SMALL <$100 MILLION	.88	1.16	1.72	14.4

- Respondent users projected very minor changes in the percentage allocation of their information processing budgets (see Exhibit IV-7). Maintenance as a percentage of the budget for very large companies is projected to diminish by 2.7% and for small companies to increase by 1.3%.

- Respondent users expected maintenance rates to increase in 1979 over 1978 in a range of 6.3% to 11% (see Exhibit IV-8). It is interesting to note that the vendors interviewed projected an increase in annual maintenance contract rates for the same time period of 8% to 15%, representing a higher rate increase than the 2-4% anticipated by users.

- Respondent users attitudes revealed that maintenance expenses and projected increases were secondary in importance to quality and timely service. Users express a desire for equipment availabiity and due to the design of the present hardware, service is required to achieve availability.

- Maintenance costs for all users interviewed averaged 13.3% of the expenditure for computers and terminals. The percentage ranged from 25% for the very large users to 10% for the small users.

  - Large and very large users have a higher purchase content of equipment. The numbers reported as expenditures for hardware would include the annual amorization of the purchase price, less reserve, spread over some number of years as opposed to the equivalent rental price. Hence, annual maintenance rates as applied to hardware expenditures would be higher than normal ratios.

  - Also included was hardware that was full depreciated but not retired.

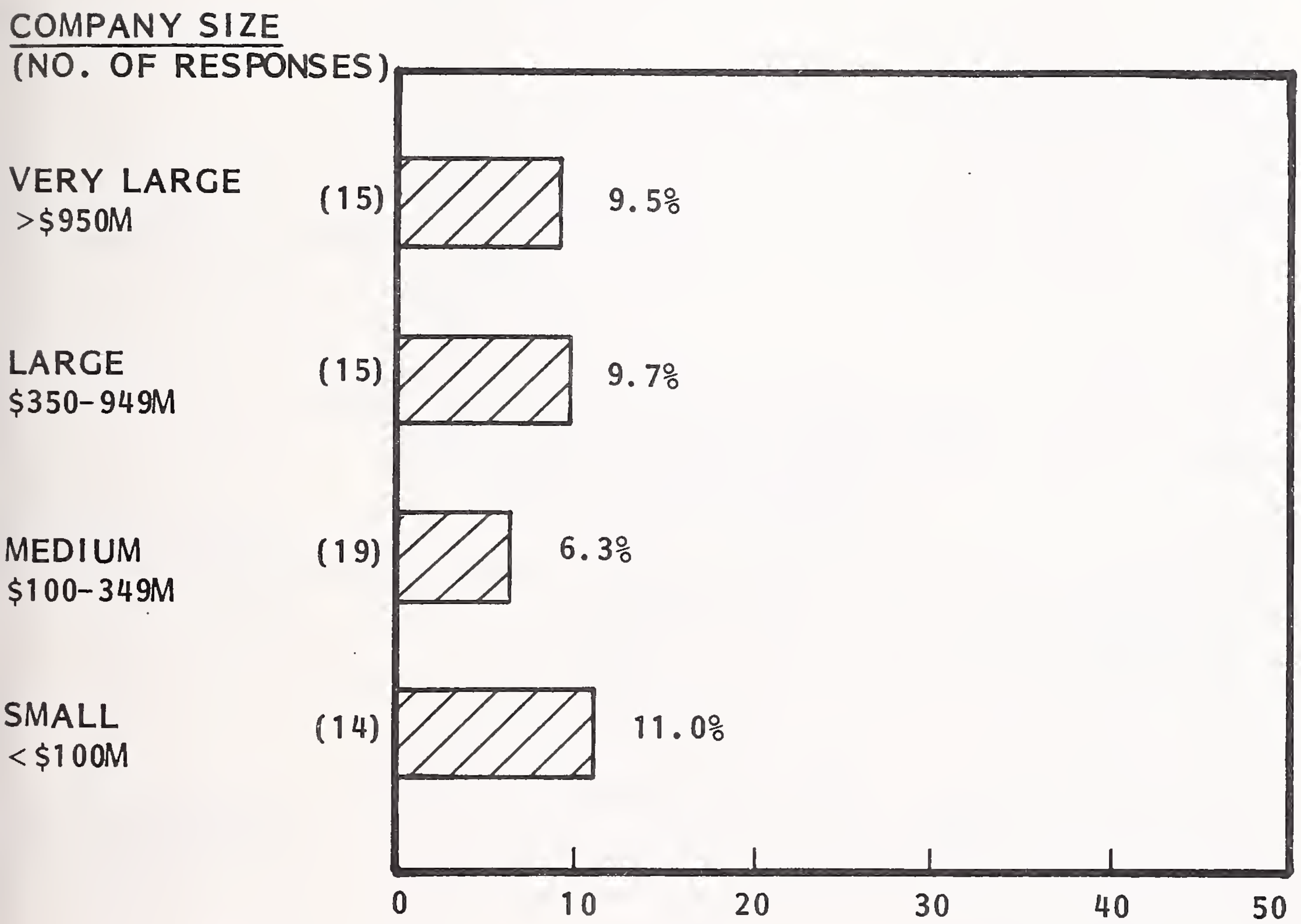
EXHIBIT IV-7

AVERAGE PERCENTAGE ALLOCATION OF RESPONDENT USER INFORMATION PROCESSING BUDGET BY SIZE OF ENTERPRISE FOR 1978, 1980, 1983

FACTOR	1978				1980				1983				AAGR			
	VERY LARGE	LARGE	MED-IUM	SMALL	VERY LARGE	LARGE	MED-IUM	SMALL	VERY LARGE	LARGE	MED-IUM	SMALL	VERY LARGE	LARGE	MED-IUM	SMALL
MEDIUM/LARGE SYSTEMS MINI/SMALL BUSINESS COMPUTERS	31.8	38.6	38.7	40.2	30.6	35.3	40.4	36.9	31.7	36.7	40.0	36.7	-0.1	-1.0	0.7	-1.8
TERMINALS	6.0	12.8	8.3	6.0	6.3	7.0	8.5	5.7	6.1	6.2	4.2	5.8	0.3	-13.5	-15.7	-0.7
DATA COMMUNICATIONS	8.6	6.2	3.9	2.3	8.0	6.5	3.7	2.7	8.4	6.0	2.9	2.5	-0.5	-0.7	-5.8	0.8
PERSONNEL	44.9	36.5	42.9	43.8	44.2	42.7	41.5	44.8	43.5	41.8	45.4	44.8	-0.1	2.7	-0.5	0.4
MAINTENANCE	8.7	5.9	6.2	7.7	5.2	5.7	5.9	7.8	7.6	5.6	6.4	8.2	-2.7	-0.6	0.6	1.3
MISCELLANEOUS	0.0	0.0	0.0	0.0	5.7	2.8	0.0	2.1	2.7	3.7	1.1	2.0	-	-	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	-	-	-

EXHIBIT IV-8

RESPONDENT USERS' ANTICIPATED PERCENTAGE OF MAINTENANCE INCREASES IN 1979 VS. 1978 BY COMPANY SIZE



PERCENTAGE OF MAINTENANCE INCREASES

B. THE IMPORTANCE OF FIELD MAINTENANCE PERFORMANCE FACTORS TO THE USER

- Respondent users tended to rank mean time to respond as being slightly more important than mean time to repair as field maintenance performance factors (see Exhibit IV-9).

  - Users perceive that once on-site the service person will repair the device in a reasonable time frame.

  - Users state that the unit cannot be fixed until the field engineer arrives; hence, mean time to respond is more important than "mean time to repair." However, it is total elapsed time that is critical.

- Preventive maintenance was ranked as very important by 48% of the users. It was ranked as unimportant by 19% of the very large users.

  - Users were split to extremes on the preventive maintenance issue. Comments ranged from "...if PM stopped I would quit my job," to "...I don't want them to touch the equipment unless it's down."

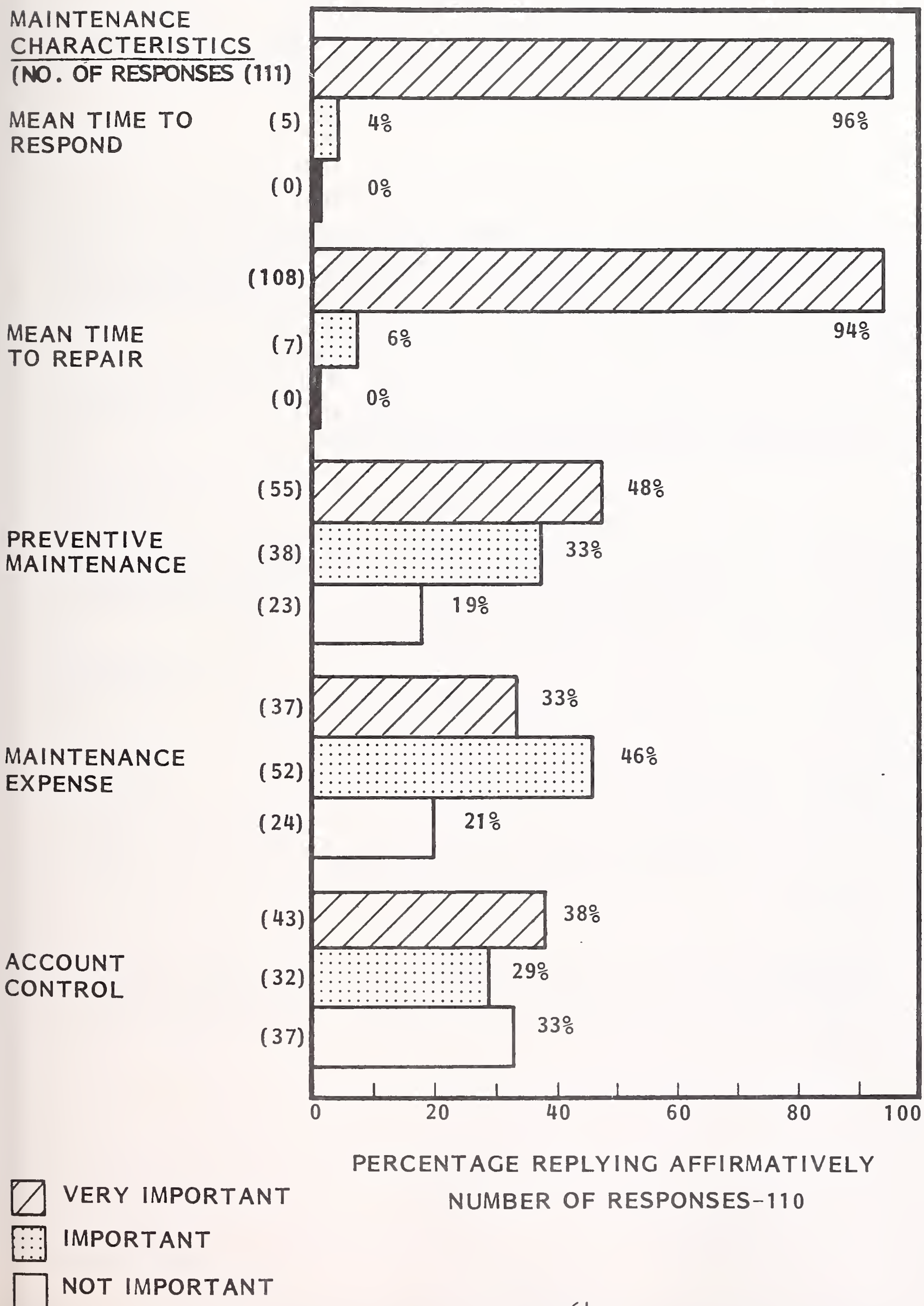
  - Users are relying on vendor guidance on the amount of preventive maintenance required, and the majority are not convinced of its value.

- While increasing maintenance expense drew a "very important" ranking from 33% of the respondent users, it is not a major point.

  - Most users were unable to state the amount of maintenance costs per year without considerable checking. If such costs were a major issue, the facts would have been more readily available.

EXHIBIT IV-9

RESPONDENT USERS' RATING OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS



- Only 23% of the large and very large users ranked maintenance expenses as "very important" (see Exhibit IV-10), indicating the cost of service is secondary to quality of service.

- Thirty eight percent of respondent end users ranked account control as very important compared to 86% of very large users.

  - Very large users are more attuned to field engineering account involvement. They are aware of the need to keep field engineering informed of plans and changes and solicit their suggestions and help in improving the installation operation.

C. RATING OF MAINTENANCE VENDORS BY THE USER

- Eighty percent of respondent users prefer to use or will only use the hardware vendor as the maintenance supplier regardless of equipment classification (see Exhibit IV-11 and IV-12). Users believe that the hardware vendor:

  - Is more concerned about the quality of service delivered.

  - Is more responsive to the user's needs.

  - Is more knowledgeable about his own product than a third party company.

  - Recognize the risk of losing hardware sales due to poor service, a threat which is not shared by the third party maintenance organizations.

EXHIBIT IV-10

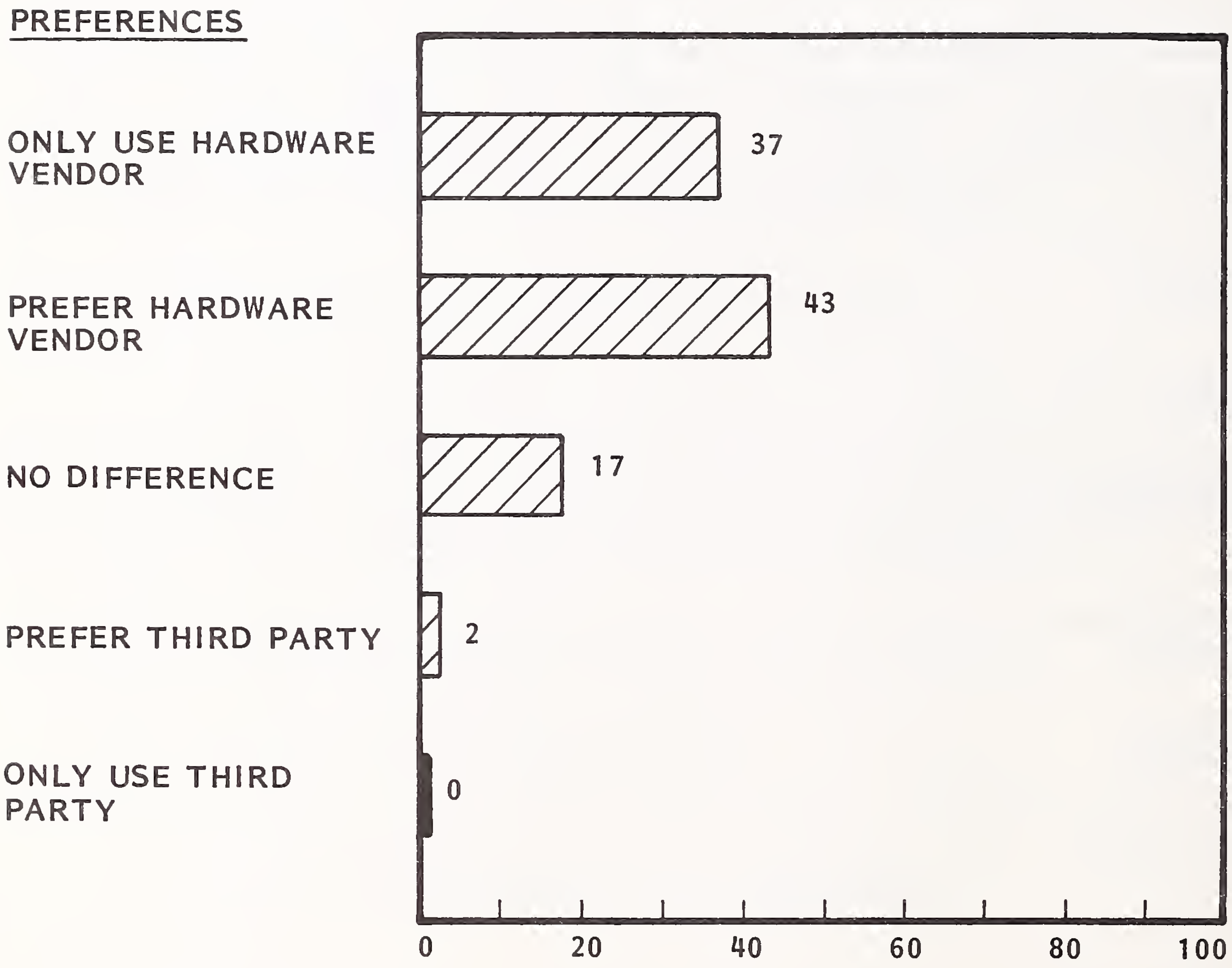
RESPONDENT USERS' RATING OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS BY COMPANY SIZE

MAINTENANCE CHARACTERISTICS	VERY LARGE > $950M			LARGE $350-949M			MEDIUM $100-349			SMALL < $100		
	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW
MEAN TIME TO RESPOND	29	1	0	24	2	0	26	1	0	31	1	0
MEAN TIME TO REPAIR	29	1	0	26	0	0	25	2	0	28	4	0
PREVENTIVE MAINTENANCE	18	8	4	9	11	6	12	8	7	16	11	5
MAINTENANCE EXPENSE	6	15	9	7	13	6	13	8	4	11	16	5
ACCOUNT CONTROL	13	8	7	6	12	8	13	3	10	11	9	12

NUMBER REPLYING AFFIRMATIVELY

EXHIBIT IV-11

RESPONDENT USERS' PREFERENCE FOR MAINTENANCE VENDOR



NUMBER OF RESPONDENTS-110

EXHIBIT IV-12

RESPONDENT USERS' PREFERENCE
FOR MAINTENANCE VENDOR
BY TYPE OF EQUIPMENT

EQUIPMENT CLASSIFICATION	ONLY USE VENDOR HARDWARE	PREFER VENDOR HARDWARE	NO DIFFERENCE	PREFER THIRD PARTY	ONLY USE THIRD PARTY	TOTAL
LARGE AND MEDIUM MAINFRAMES	44	38	16	3	0	101
	44%	38%	16%	3%	0%	100%
SMALL BUSINESS COMPUTERS	16	25	8	1	0	50
	32%	50%	16%	2%	0%	100%
OTHER MINI-COMPUTERS	17	29	11	0	0	57
	30%	51%	19%	0%	0%	100%
PLUG COMPATIBLE PERIPHERALS	30	28	14	2	0	74
	41%	38%	19%	3%	0%	100%
TERMINALS	33	41	16	2	0	92
	36%	45%	17%	2%	0%	100%
TOTAL RESPONSES	140	161	65	8	0	374
TOTAL % REPLYING	37%	43%	17%	2%	-	-

D. USER ATTITUDES TOWARD THE INSTALLATION AND MAINTENANCE OF EDP EQUIPMENT

- Respondent end users expressed a high level of interest in participating in traditional maintenance functions (see Exhibit IV-13).

  - Forty percent of the users are currently performing or would consider performing the installation of equipment.

    - When maintaining or delivering the equipment to a repair site, the installation function is dependent upon size and complexity of the task to be performed. Equipment addressed in these responses were mostly limited to modems, terminals, etc.

  - The limiting factors on maintaining the equipment as expressed by the respondent users related to:

    - No one on the staff at the moment that could assume this task.

    - Inability to keep an employee technically compent unless the equipment experienced excessive downtime.

    - No career path for an in-house field engineer.

    - It is a service that is readily available and one that the user would prefer to purchase rather than staff in-house.

- In spite of the restraints covered above, 30% of the respondent users would assume their own maintenance repair service for dollar savings (see Exhibit IV-14).

EXHIBIT IV-13

RESPONDENT USERS ACTUALLY OR POTENTIALLY PERFORMING MAINTENANCE TASKS, BY COMPANY SIZE

TASK	PRESENTLY PERFORMING				TOTAL	WOULD CONSIDER PERFORMING				TOTAL	PERCENTAGE PRESENTLY OR POTENTIALLY PERFORMING					PERCENT
	VL	L	M	S		VL	L	M	S		VL	L	M	S	TOTAL	
INSTALLING EQUIPMENT	7	4	3	5	19	11	10	8	11	40	18	14	11	16	59	40%
RUNNING DIAGNOSTICS	8	8	9	10	35	23	22	20	28	93	31	30	29	38	128	88
PERFORMING MAINTENANCE	2	1	4	7	14	4	5	8	12	29	6	6	12	16	40	29
DELIVERING FAULTY EQUIPMENT FOR REPAIR	3	2	2	1	8	10	8	3	10	31	13	10	5	11	39	27

VERY LARGE=VL
LARGE =L
MEDIUM =M
SMALL =S

NUMBER OF RESPONDENTS-109

EXHIBIT IV-14

RESPONDENT USERS' REQUIRED COST SAVINGS FOR PERFORMING THEIR OWN MAINTENANCE

COST SAVINGS REQUIREMENT	ENTERPRISE SIZE				TOTAL RE-SPONSES	PER-CENTAGE OF RE-SPONSES
	VERY LARGE	LARGE	MEDIUM	SMALL		
10% OR LESS	1	0	0	0	1	3%
11-20%	1	2	1	4	8	26
21-30%	2	3	4	2	11	35
OVER 30%	2	3	2	4	11	35
TOTAL THAT WOULD CONSIDER	6	8	7	10	31	30
WOULD NOT CONSIDER	21	16	17	18	72	70
TOTAL	-	-	-	-	103	100%

NUMBER OF RESPONDENTS-103

30% OF TOTAL RESPONDENTS (31 OUT OF 103) INDICATED THEY WOULD BE WILLING TO TAKE OVER THEIR OWN MAINTENANCE.

- Eighty-eight percent of the respondent vendors were predisposed to running diagnostics prior to placing a service call. The retarding factors as cited by the user are:

  - Lack of diagnostics for their equipment.

  - Results of the diagnostic test program are not easy to comprehend.

  - Required training for the operation personnel to perform this task.

- Respondent users perceive that running diagnostics will enable the field engineer to arrive with the required spares, proper tools, scopes, etc., and reduce mean time to repair.

  - These diagnostics will also enable operations personnel to improve available time on the hardware by proving rather than assuming the need for a service call when an operator error or application program may be the problem.

E. MINIMAL ACCEPTABLE MAINTENANCE PERFORMANCE AS REPORTED BY USERS AND VALUE PLACED ON IMPROVEMENTS IN PERFORMANCE

- Respondent users reported two hours to be an acceptable average for "in-person" mean time to respond (see Exhibit IV-15).

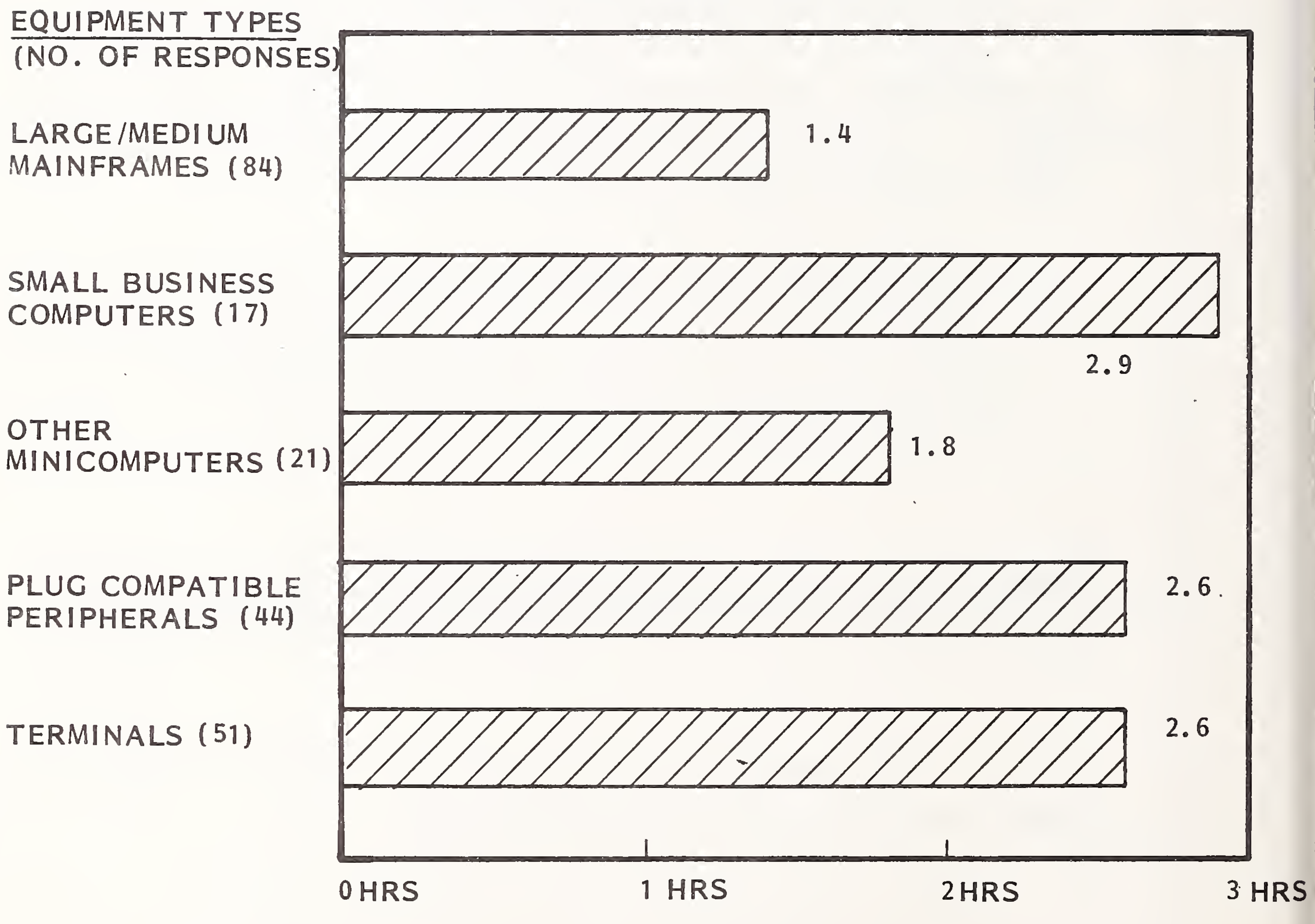
  - Most demanding (1.4 hours) were large/medium mainframes.

  - Least demanding (2.9 hours) were small business computers.

  - Numerous users reported response times that were faster than required and that vendors were more responsive than requested!

EXHIBIT IV-15

RESPONDENT USERS MINIMUM ACCEPTABLE
MEAN TIME TO RESPOND BY CLASS OF EQUIPMENT



TOTAL RESPONDENTS-217

- Respondent users reported an average of five hours and fifteen minutes as acceptable for mean time to repair (see Exhibit IV-16).

  - A minimum of four and a maximum of six hours were reported.

  - As with mean time to respond, numerous users reported repair times that were faster than required.

- Fifty-eight percent of users consider mean time between failures (MTBF) of one month as acceptable. A failure was defined as system or unit outage that required a service call (see Exhibit IV-17).

- Only 5% of the users required MTBF in excess of six months.

- As shown in Exhibit IV-18, 29% of respondent users expressed dissatisfaction with the present level of mean time to respond as supplied by their maintenance vendor and are willing to pay more money for an improvement.

  - Mainframe equipment users were most critical, with 56% reporting dissatisfaction with mean time to respond.

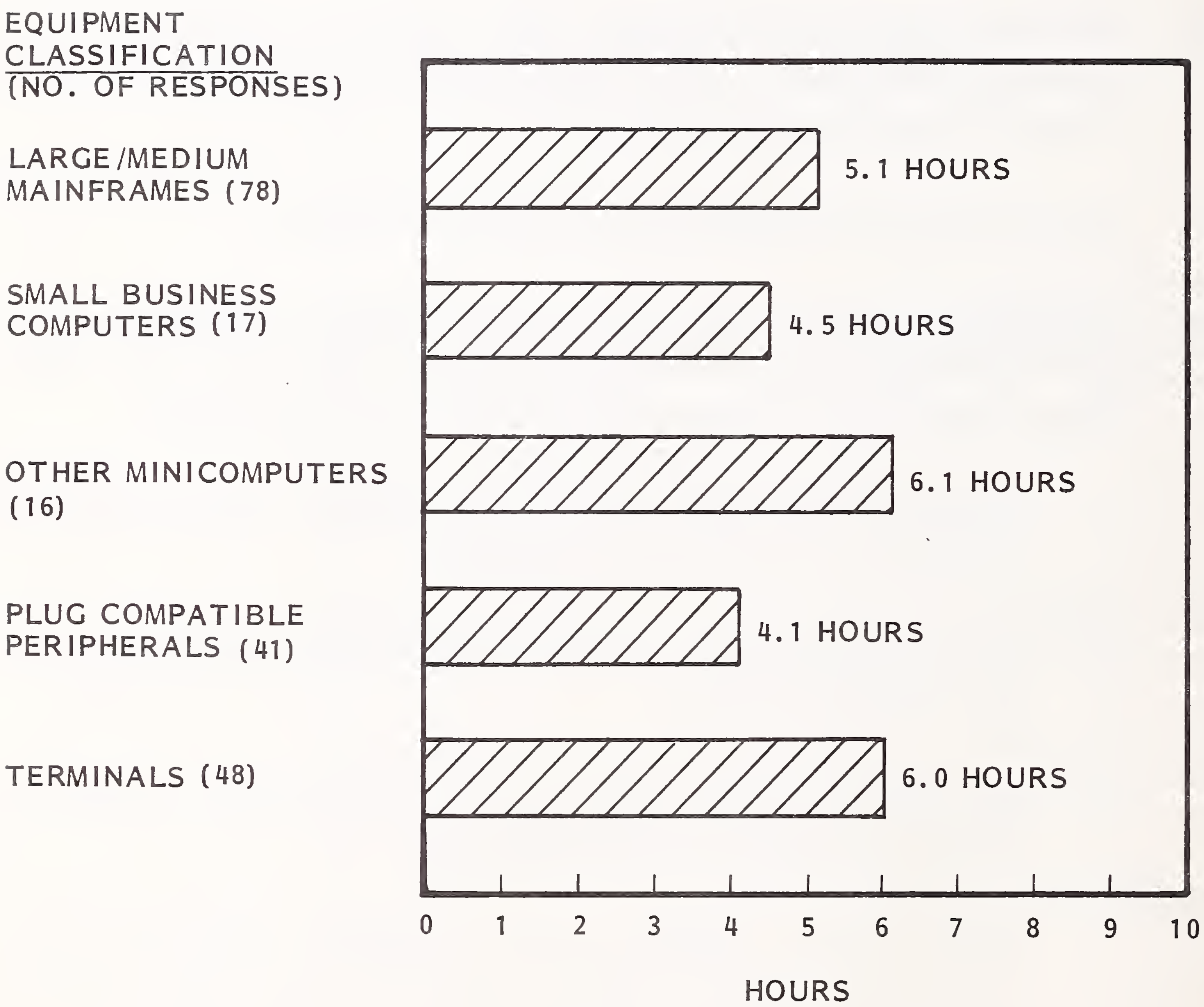
  - Users of minicomputers and plug compatible peripherals reported a 31-38% dissatisfaction level.

  - Excluding minicomputer users, over half of the respondents stated they would pay more for improved response time.

  - Users reported a willingness to pay an increased 17-22% over present maintenance rates for an average improvement in mean time to respond from 3.5 hours to 1.1 hours (see Exhibits IV-19, IV-20, and IV-21).

EXHIBIT IV-16

RESPONDENT USERS' MINIMUM ACCEPTABLE MEAN TIME TO REPAIR BY CLASS OF EQUIPMENT



NUMBER OF RESPONSES-200

EXHIBIT IV-17

RESPONDENT USERS' MINIMUM ACCEPTABLE
MEAN TIME BETWEEN FAILURES

MINIMUM ACCEPTABLE MEAN TIME	VERY LARGE	LARGE	MEDIUM	SMALL	TOTAL	
					RE-SPONSES	PERCENT-AGE
LESS THAN OR EQUAL TO ONE WEEK	13	16	6	5	40	31%
	34%	39%	27%	19%		
MORE THAN ONE WEEK AND LESS THAN OR EQUAL TO ONE MONTH	5	14	7	8	34	27
	13%	34%	32%	30%		
MORE THAN ONE MONTH AND LESS THAN OR EQUAL TO SIX MONTHS	20	10	5	13	48	38
	53%	24%	23%	48%		
MORE THAN SIX MONTHS	0	1	4	1	6	5%
	0%	2%	18%	4%		
TOTAL	38	41	22	27	128	100%

EXHIBIT IV-18

RESPONDENT USERS' SATISFACTION/ DISSATISFACTION WITH MEAN TIME TO RESPOND

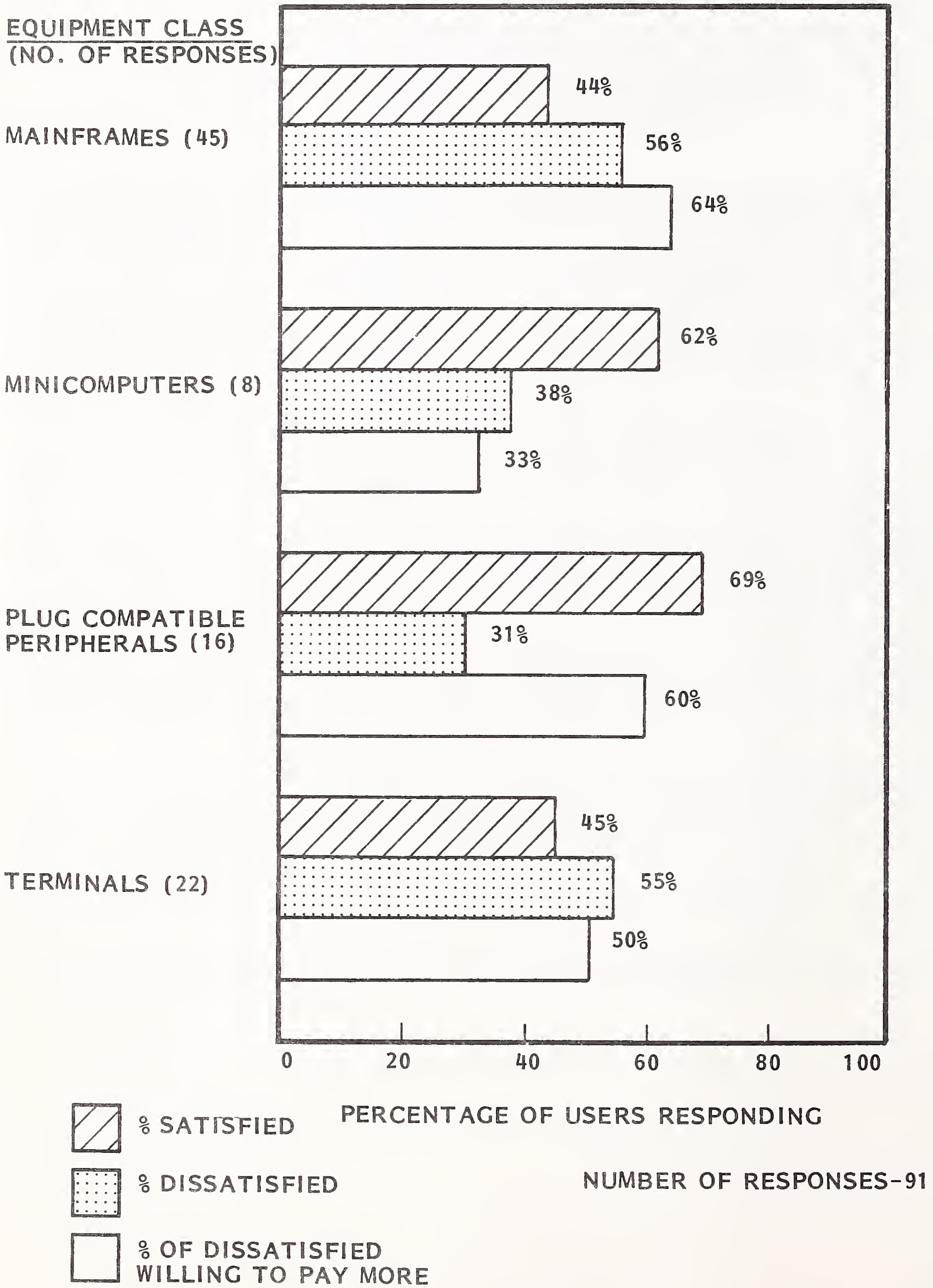
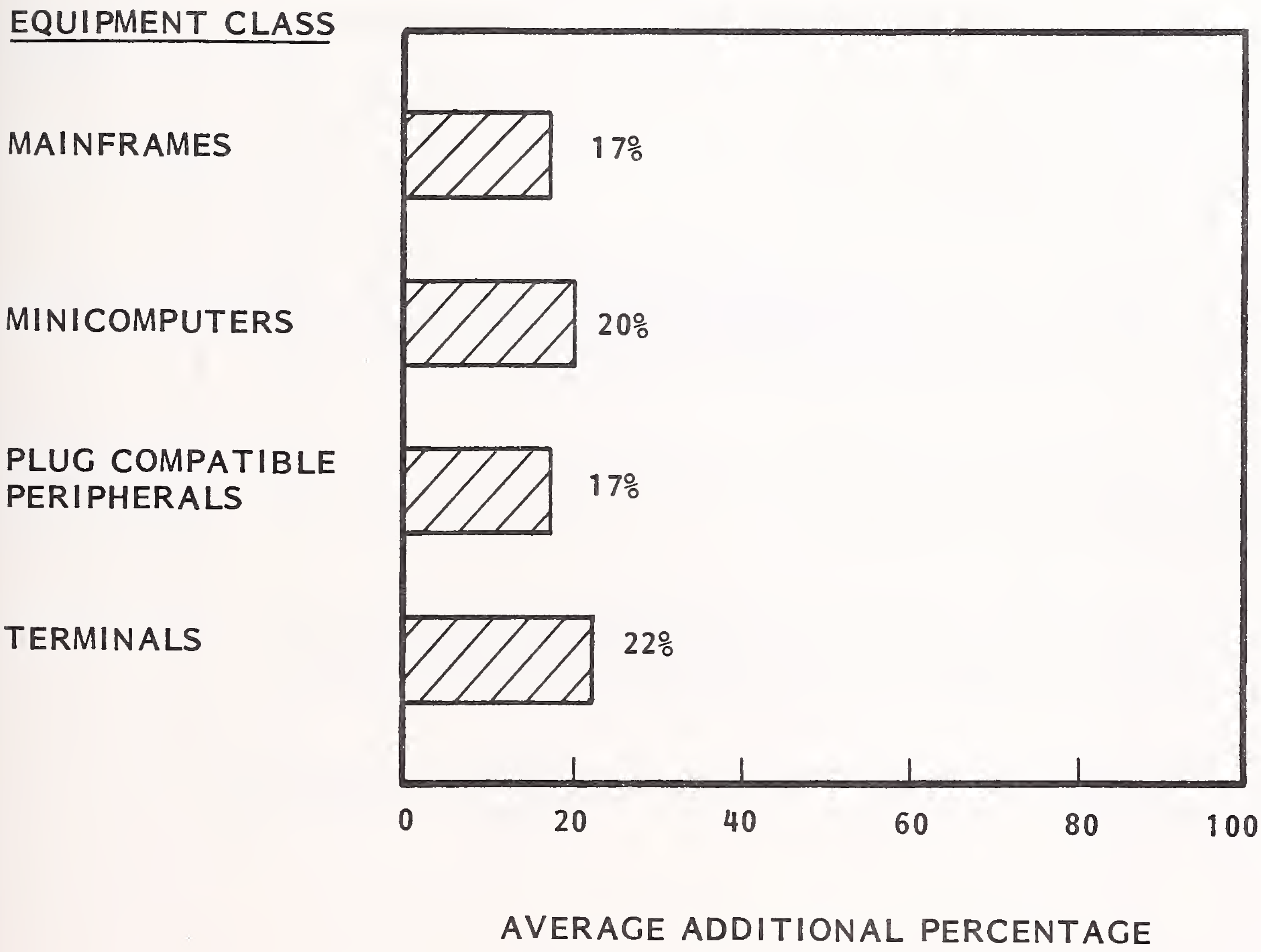


EXHIBIT IV-19

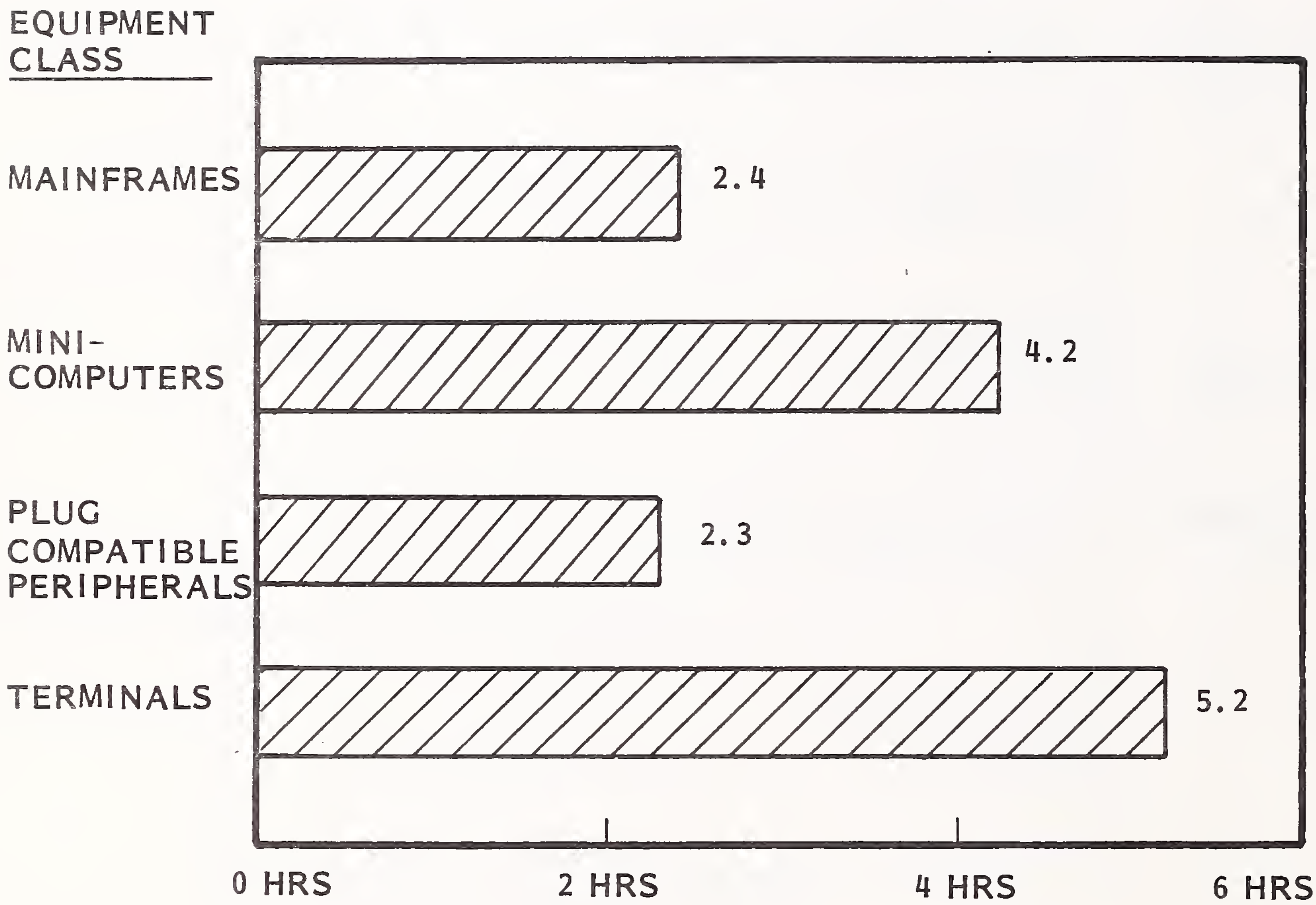
AVERAGE ADDITIONAL PERCENTAGE RESPONDENT
USERS WOULD BE WILLING TO PAY FOR
IMPROVED RESPONSE TIME



NUMBER OF RESPONSES-26

EXHIBIT IV-20

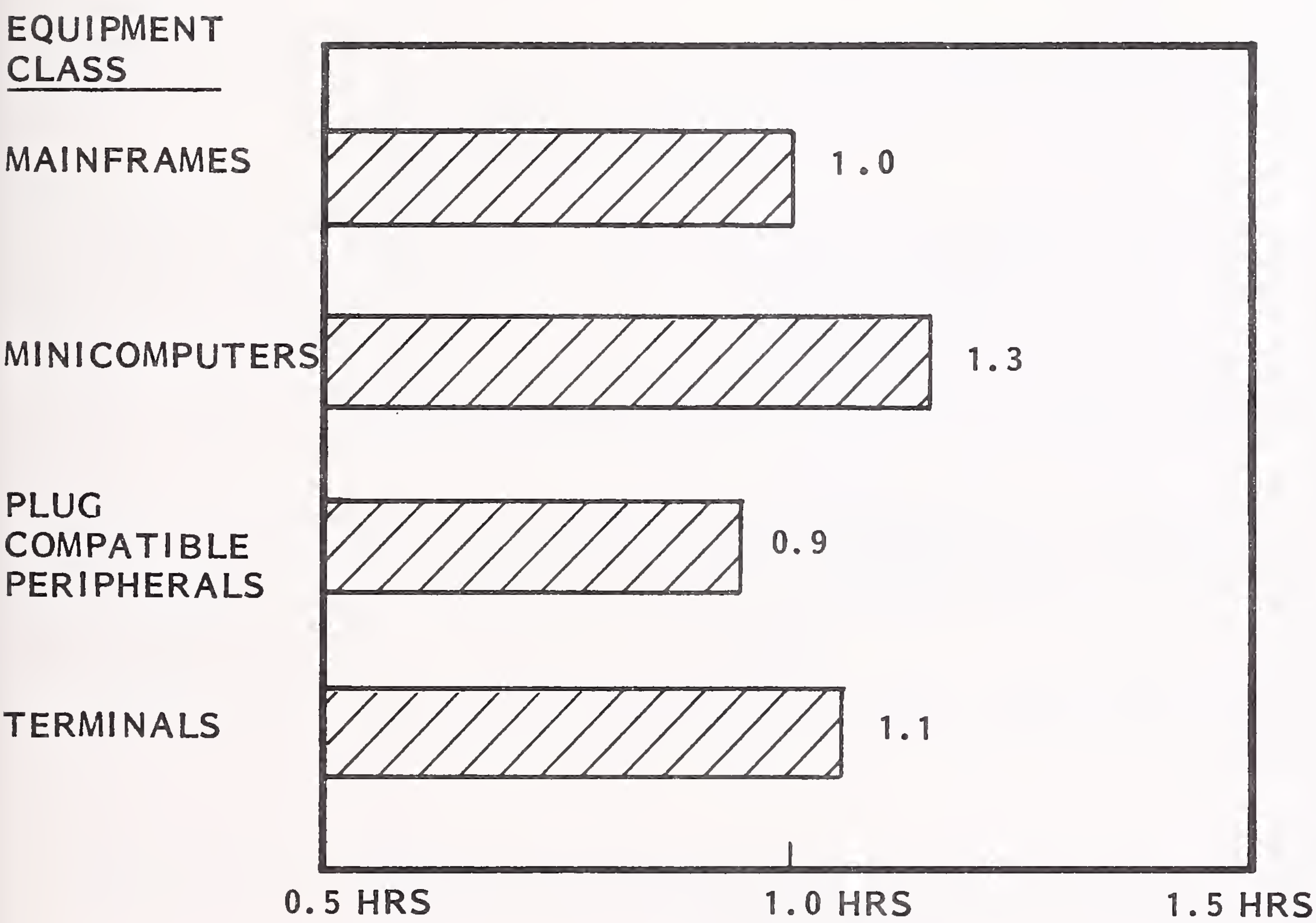
AVERAGE RESPONSE TIME OF DISSATISFIED RESPONDENT USERS



NUMBER OF RESPONSES-45

EXHIBIT IV-21

DESIRED AVERAGE RESPONSE TIME OF DISSATISFIED RESPONDENT USERS



NUMBER OF RESPONSES-45

- Fifty-three percent of the respondent users expressed dissatisfaction with the present level of mean time to repair as supplied by their maintenance vendor and would be willing to pay more money for an improvement (see Exhibit IV-22).

  - Exhibit IV-23 shows that users would pay an increase of 7.5% to 31% over present maintenance rates for an average improvement in mean time to repair from 7.9 hours to 1.6 hours.

  - The longest average repair time (12 hours) was reported by mini-computer and terminal users (see Exhibit IV-24).

  - As shown in Exhibit IV-25, all categories of users desire an average repair time of two hours or less.

- The attitudes of respondent users toward mean time to respond and repair are:

  - The majority of respondents report that they are pleased with the service at the present time.

  - Some users expect performance but are unwilling to pay for improvement.

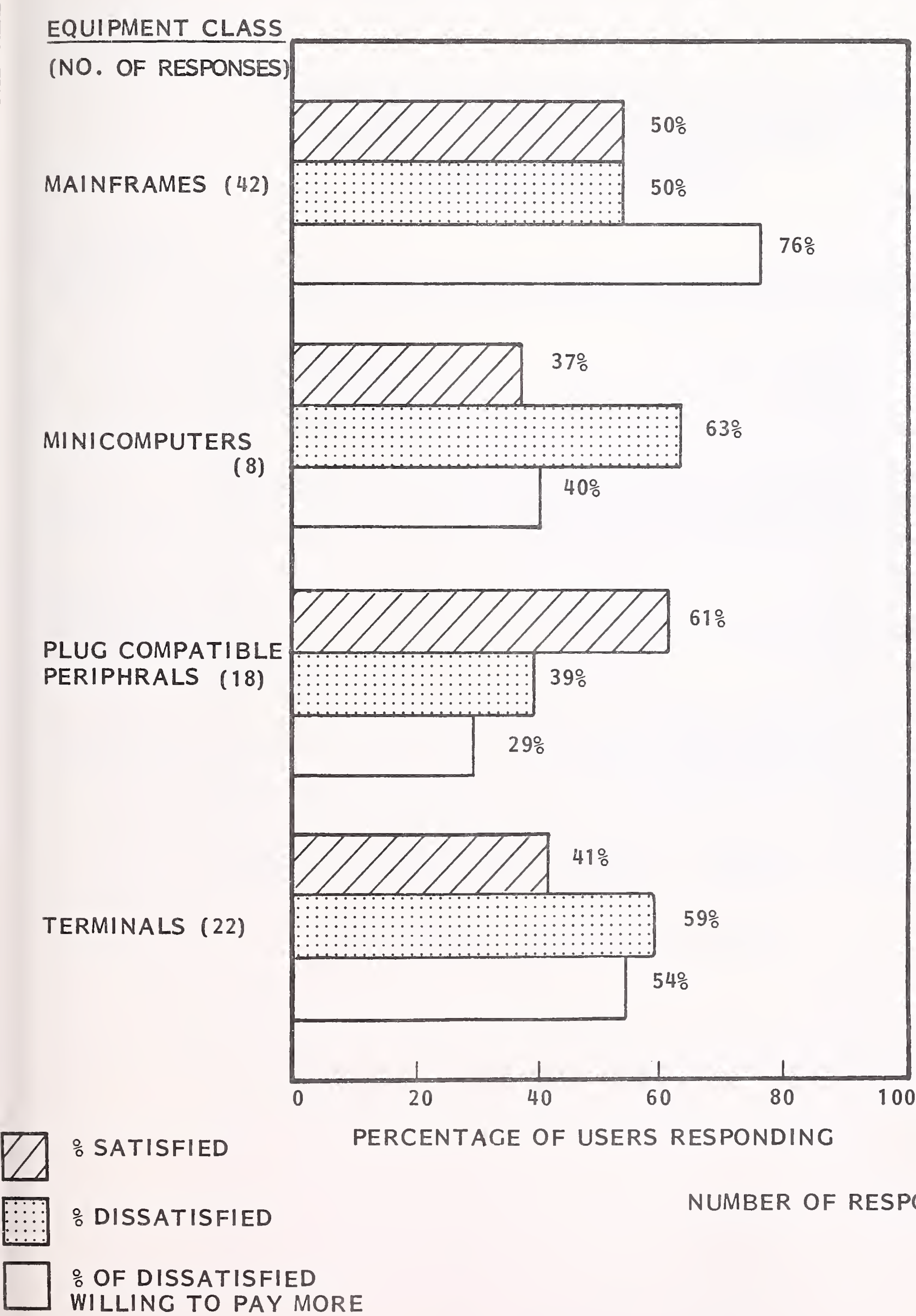
  - Those that are willing to pay an increased amount have not established a realistic price for improvement.

  - Some users are receiving better and more responsive service than is required from an equipment vendor.

- While averages can be calculated for improvements in maintenance performance by class of equipment, these numbers can be misleading.

EXHIBIT IV-22

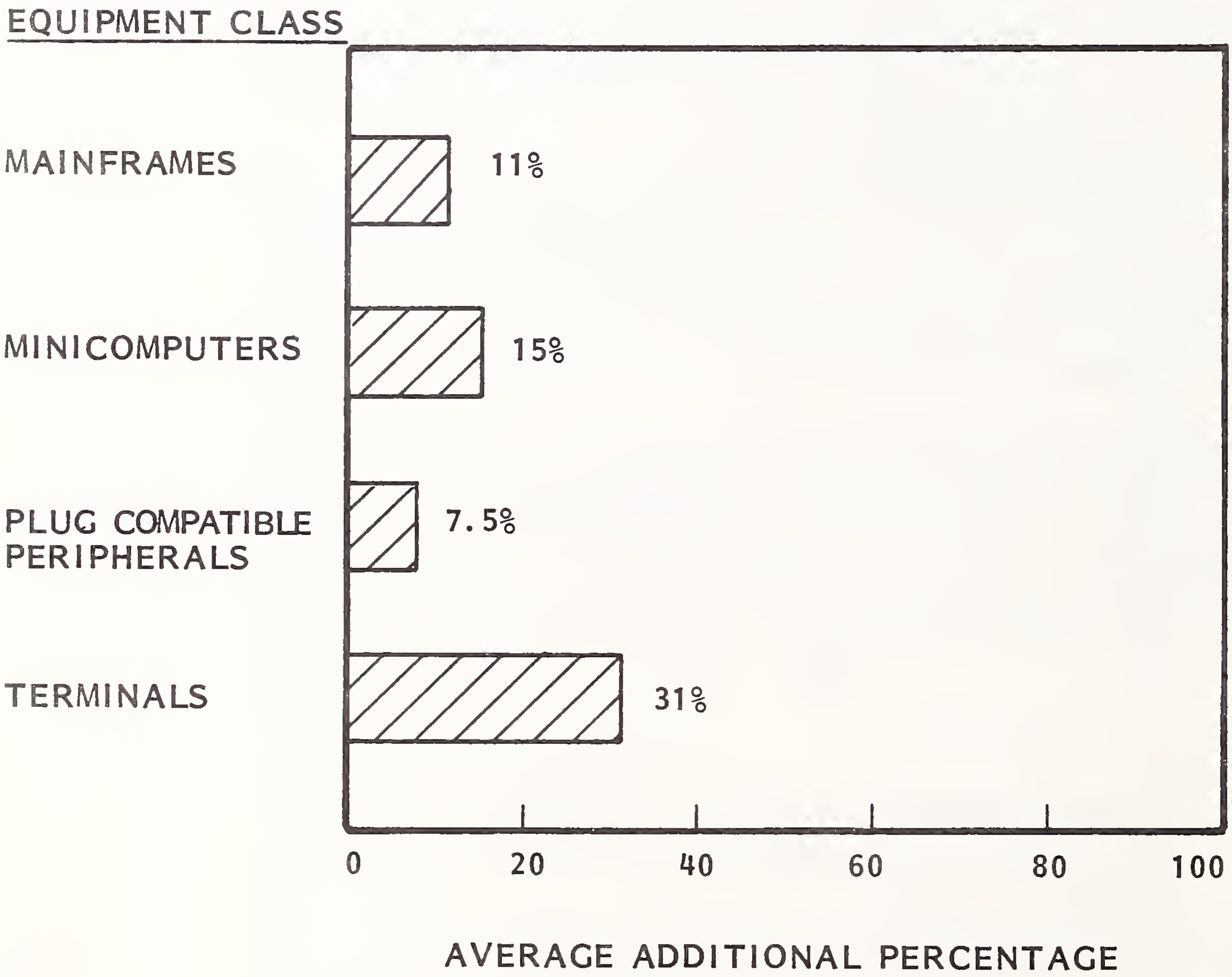
RESPONDENT USERS' SATISFACTION/DISSATISFACTION WITH MEAN TIME TO REPAIR



NUMBER OF RESPONSES-91

EXHIBIT IV-23

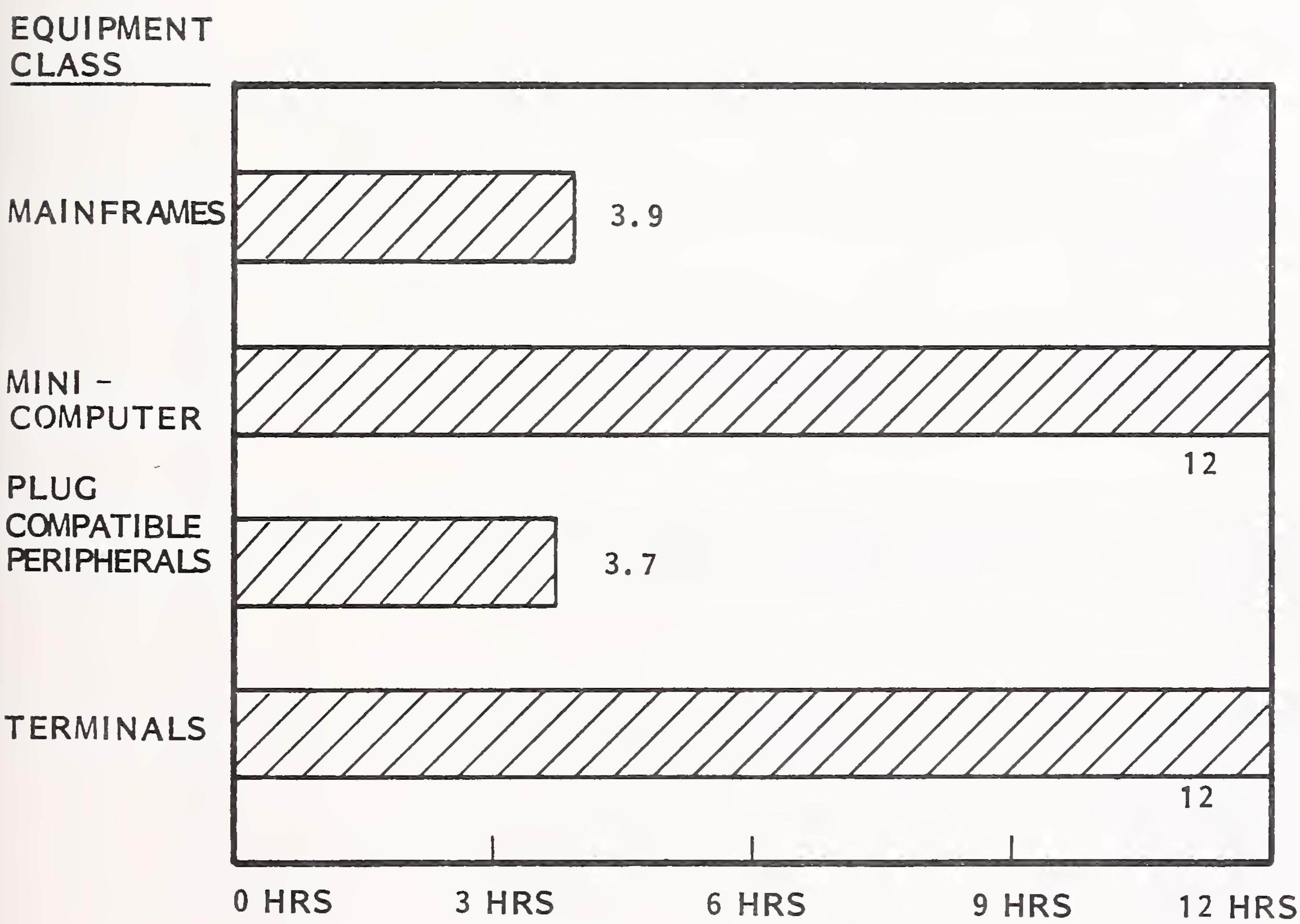
AVERAGE ADDITIONAL PERCENTAGE RESPONDENT USERS WOULD BE WILLING TO PAY FOR IMPROVED REPAIR TIME



NUMBER OF RESPONSES-27

EXHIBIT IV-24

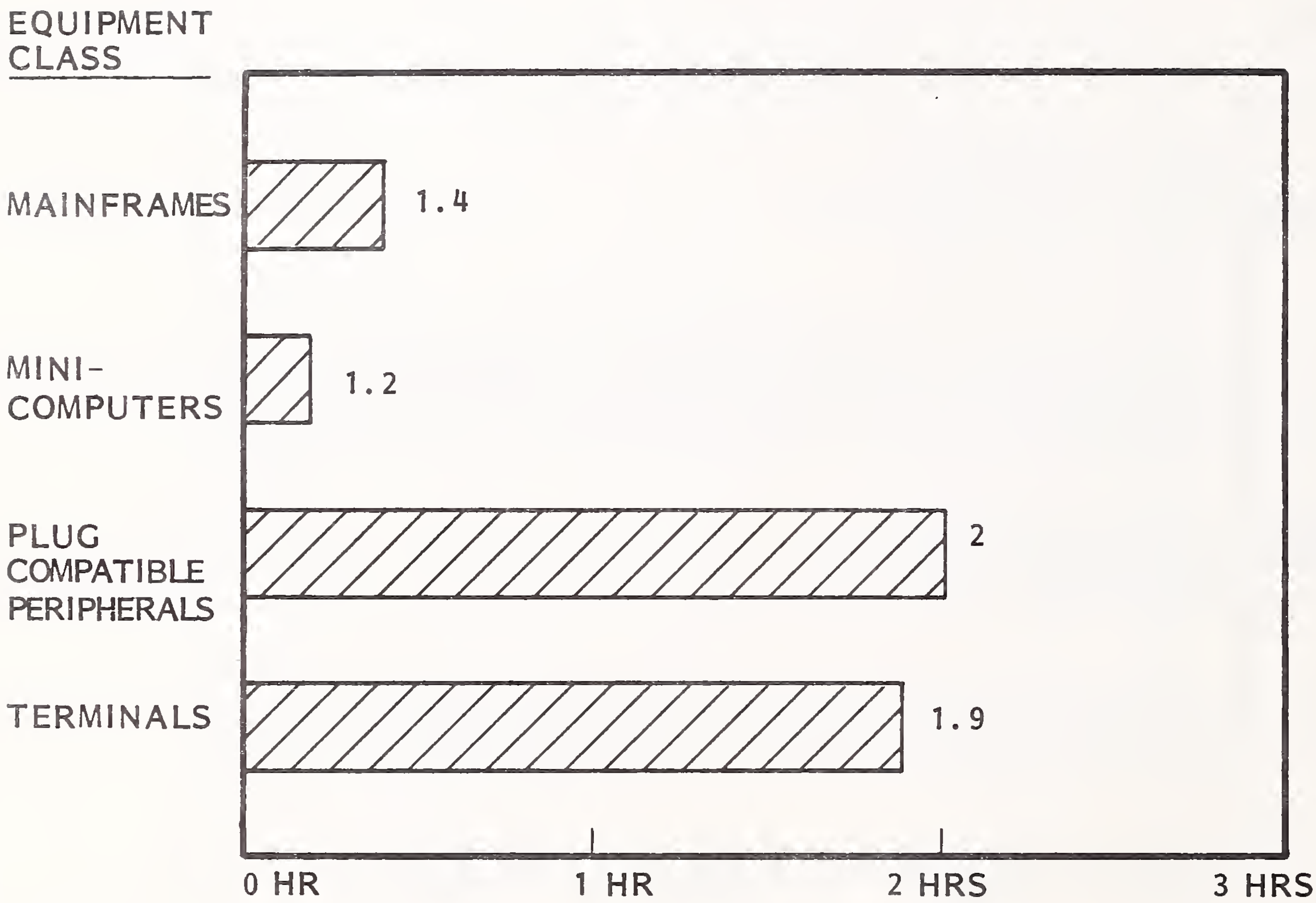
AVERAGE REPAIR TIME OF DISSATISFIED RESPONDENT USERS



NUMBER OF RESPONSES-43

EXHIBIT IV-25

DESIRED AVERAGE REPAIR TIME OF DISSATISFIED RESPONDENT USERS



NUMBER OF RESPONSES-45

- Availability required may depend on the application being processed; e.g., equipment used in a lab environment may not be used for days and then an experiment is performed and it must run for several hours.

- Availability required may depend on the time of the month; e.g., equipment used for month end closing must be operable shortly before and after month end.

- Availability required may depend on the number of spares which can be used for back up; e.g., a facility may have multiple terminals installed all of which are used during the week when service is critical. On the weekend with a smaller staff, service may not be important as personnel may move to another terminal if one is out of service.

- The maintenance service required is not a function of the class of equipment but the method and timing of equipment utilization.

F. INCIDENCE OF DOWNTIME ON EQUIPMENT AS REPORTED BY USERS

- Respondent users ranked those installations that were the most disruptive when out of service as shown in Exhibit IV-26. Computer consoles ranked highest with 74% of users reporting "very disruptive." Card punches were rated the least disruptive for the group, since most users believe the systems can still operate and virtually complete interface can be continued.

  - Computer consoles were not as disruptive for the large and very large users since there was generally an on-site spares back-up for preventing an extensive outage (see Exhibit IV-27 and IV-28).

  - Outages for disk drives and front end communication devices were reported as disruptive for all respondent users.

EXHIBIT IV-26

RESPONDENT USERS' RANKING OF THE MOST DISRUPTIVE DEVICES WHEN OUT OF SERVICE

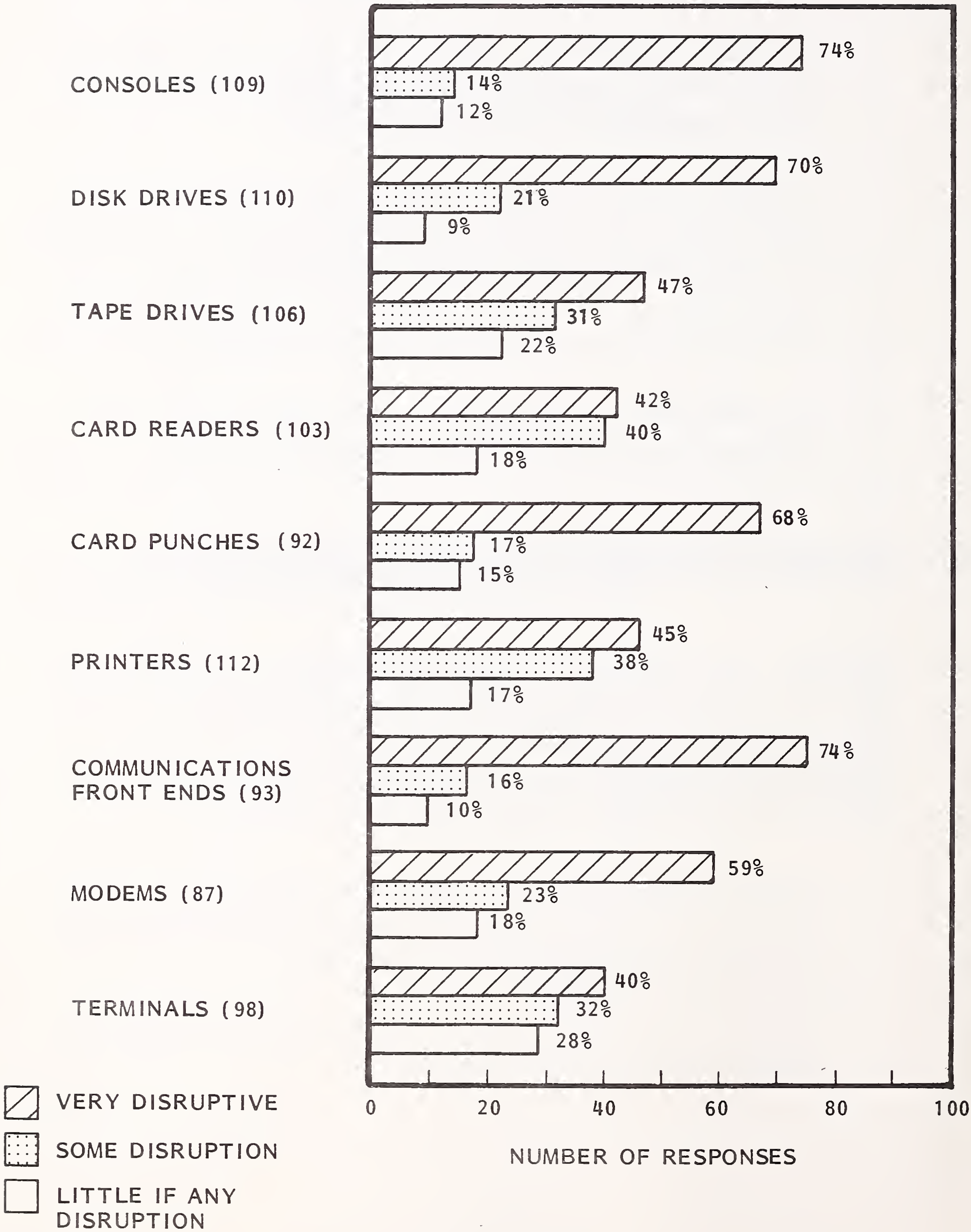
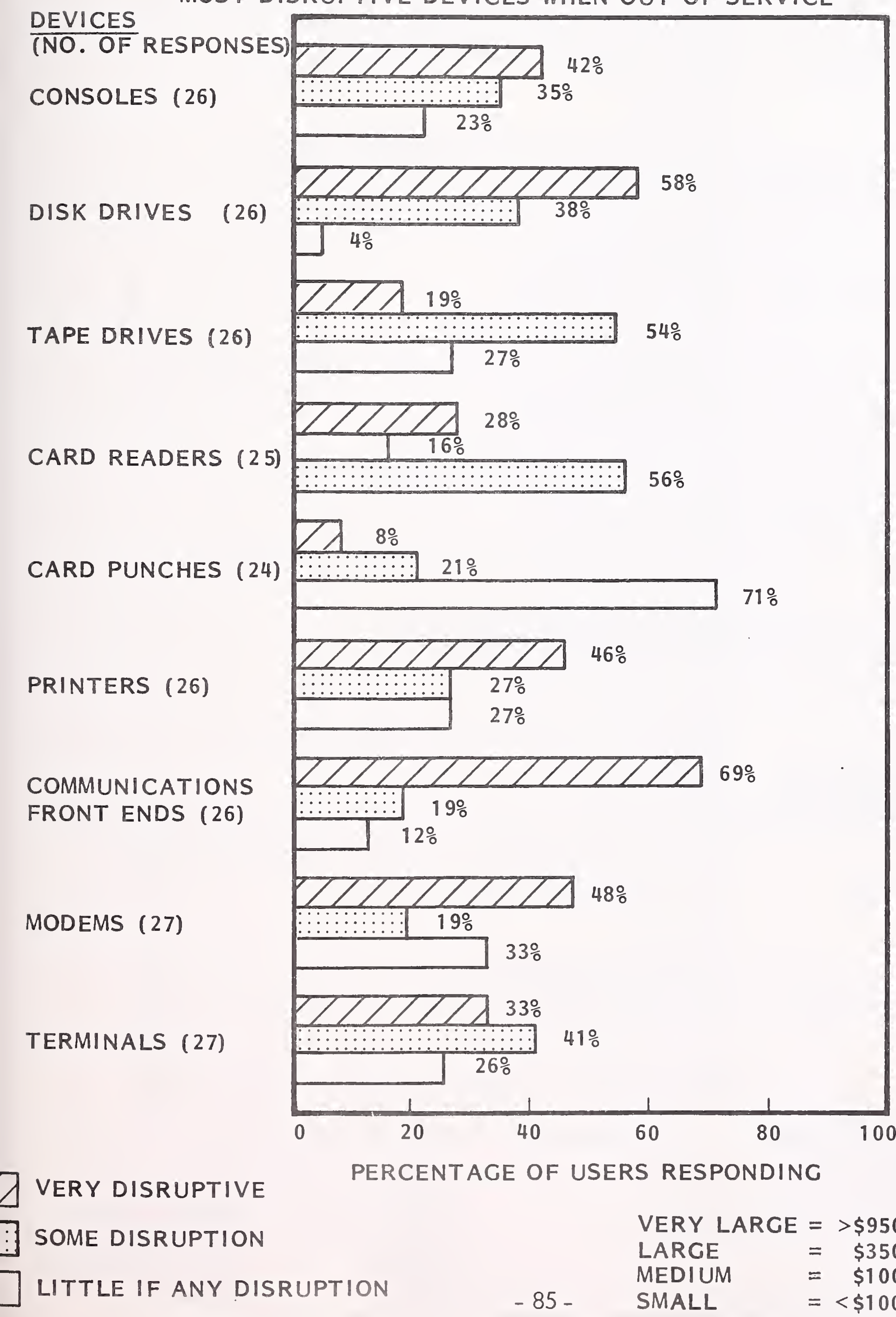


EXHIBIT IV-27

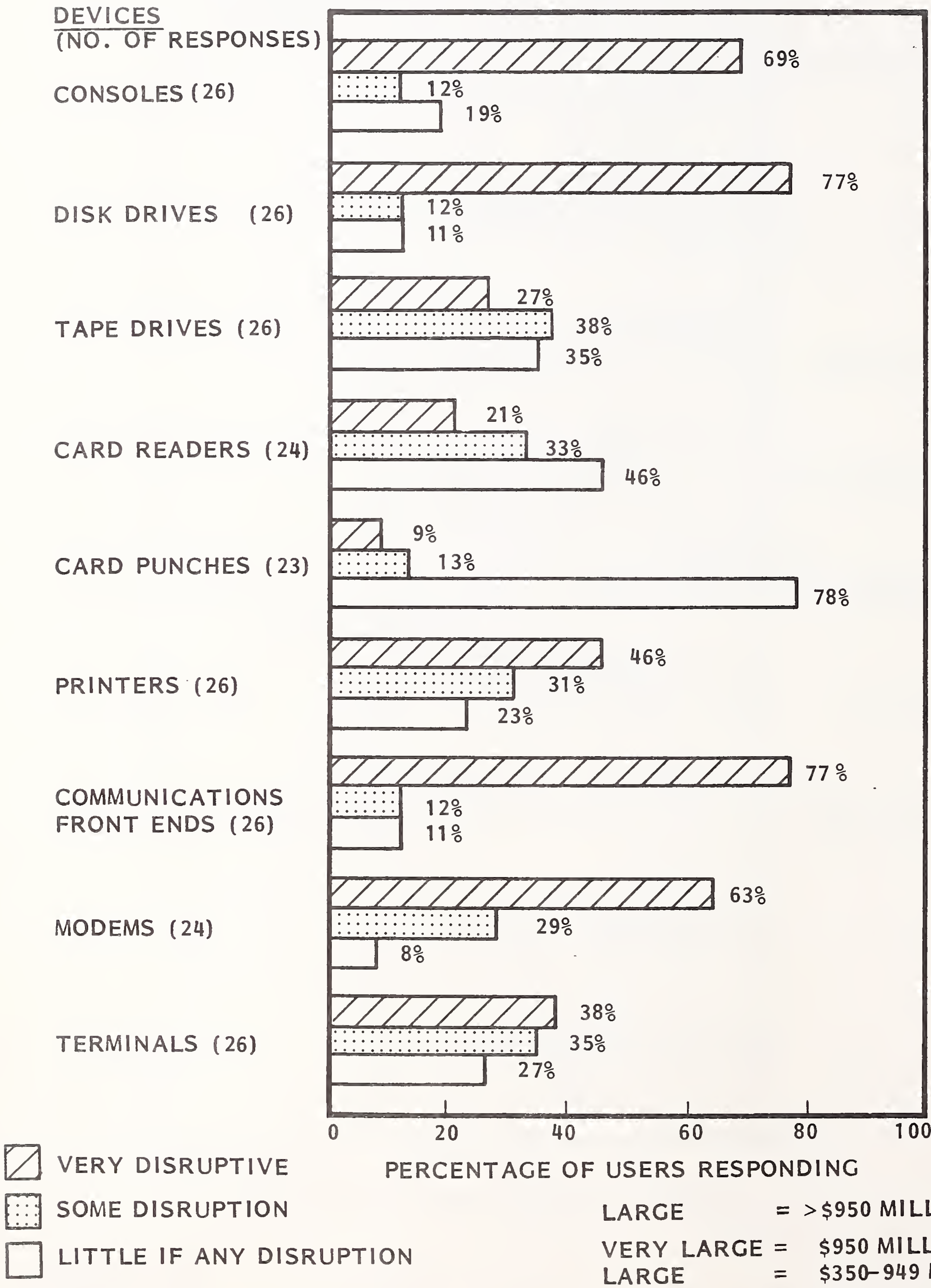
VERY LARGE SIZE RESPONDENT USER RANKING OF THE MOST DISRUPTIVE DEVICES WHEN OUT OF SERVICE



VERY LARGE = >$950 MILLION
LARGE = $350–949 MILLION
MEDIUM = $100–349 MILLION
SMALL = <$100 MILLION

EXHIBIT IV-28

LARGE SIZE RESPONDENT USER RANKING OF THE MOST DISRUPTIVE DEVICES WHEN OUT OF SERVICE



LARGE = >$950 MILLION

VERY LARGE = $950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = < $100 MILLION

- Eighty-six percent of the respondent users utilized communications in some form, and modems were ranked as very disruptive by 59%. This number would have been higher except for back-up spares.

- Medium size users report common concern to the large user (see Exhibit IV-29).

- Card readers rated little or no disruption except for small users where it achieved a rating of 70% (see Exhibit IV-30). This highlights the trend away from card dependence in larger facilities plus availability of spare machines.

- Respondent users were asked to rank the equipment that was "down" the most and the least.

  - Mechanical devices such as printers and tape drives are down the most; consoles and communications front ends were down the least (see Exhibit IV-31).

  - Respondents report devices that cause the most disruption when out of service are perceived to be down the least. Those that cause the least disruption when out of service are perceived to be down the most.

G. EQUIPMENT REPLACED BY USERS RESULTING FROM INADEQUATE MAINTENANCE

- The total of all users interviewed reported that 29% had replaced one or more pieces of equipment in the past two years due to excessive downtime (see Exhibit IV-32).

EXHIBIT IV-29
MEDIUM SIZE RESPONDENT USER RANKING OF THE MOST DISRUPTIVE DEVICES WHEN OUT OF SERVICE

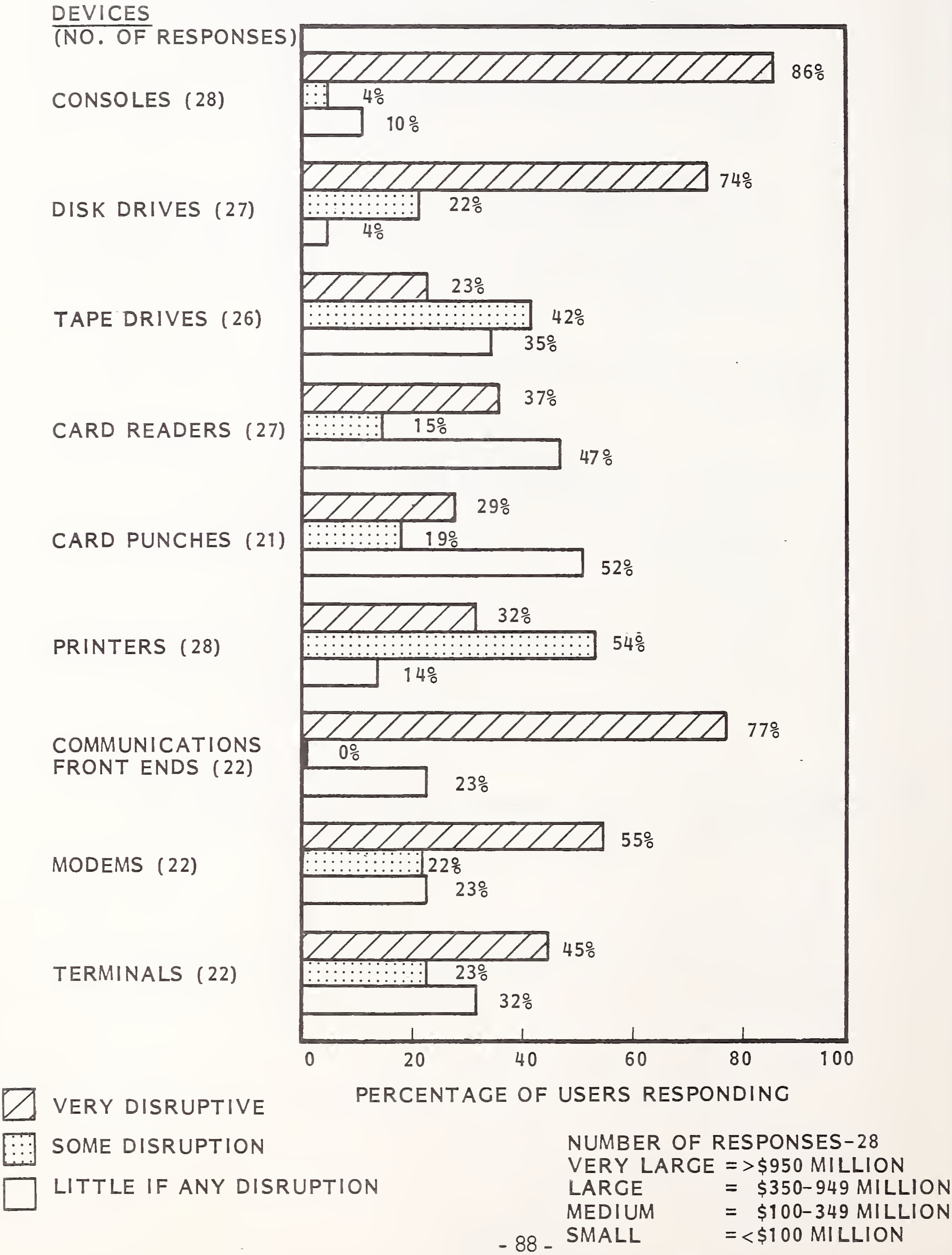
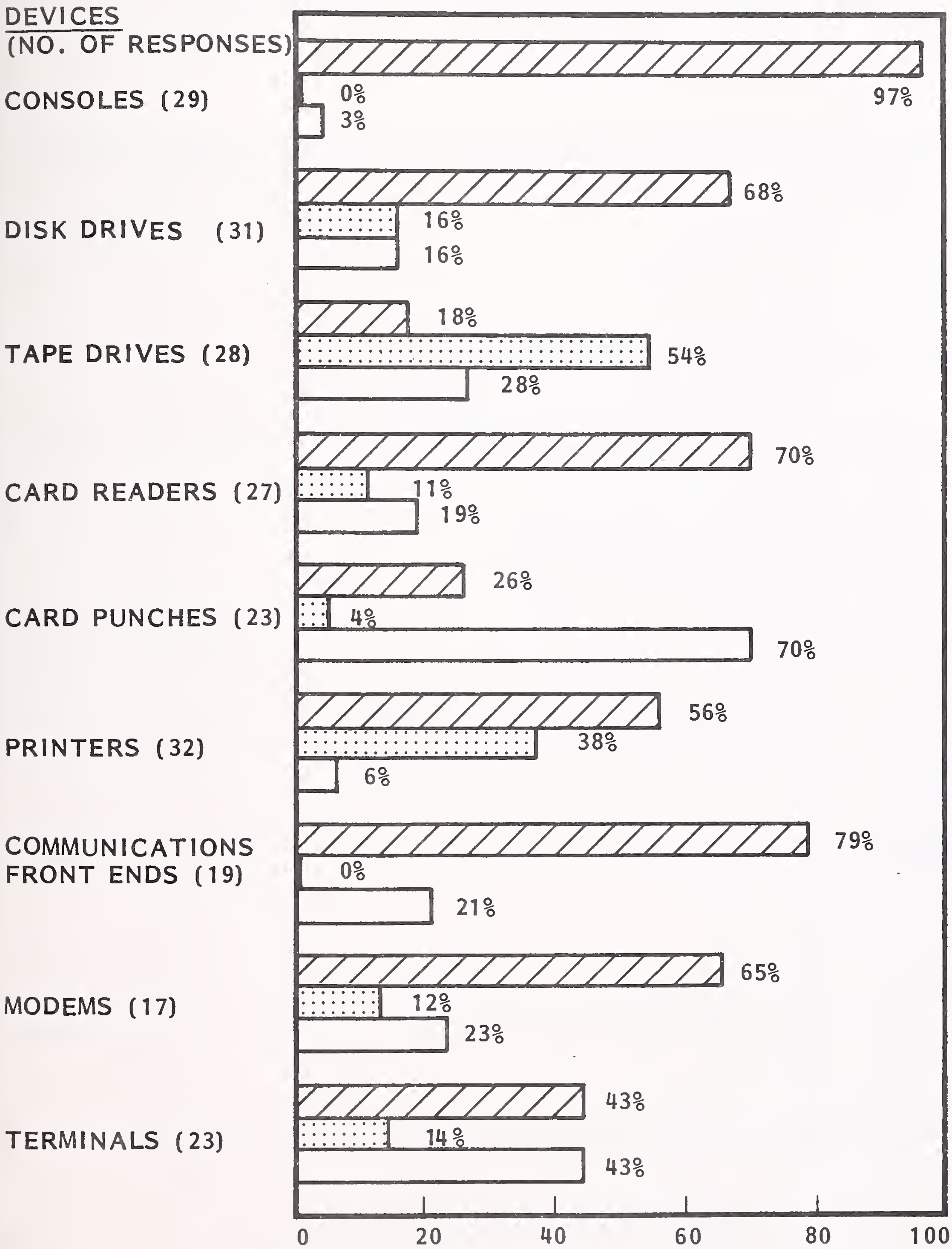


EXHIBIT IV-30

SMALL SIZE RESPONDENT USER RANKING OF THE MOST DISRUPTIVE DEVICES WHEN OUT OF SERVICE



VERY DISRUPTIVE

SOME DISRUPTION

LITTLE IF ANY DISRUPTION

NUMBER OF RESPONSES-32
VERY LARGE = >$950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = <$100 MILLION

EXHIBIT IV-31

RESPONDENT USERS' PERCEPTIONS OF THE DEVICES OUT OF SERVICE THE MOST AND THE LEAST

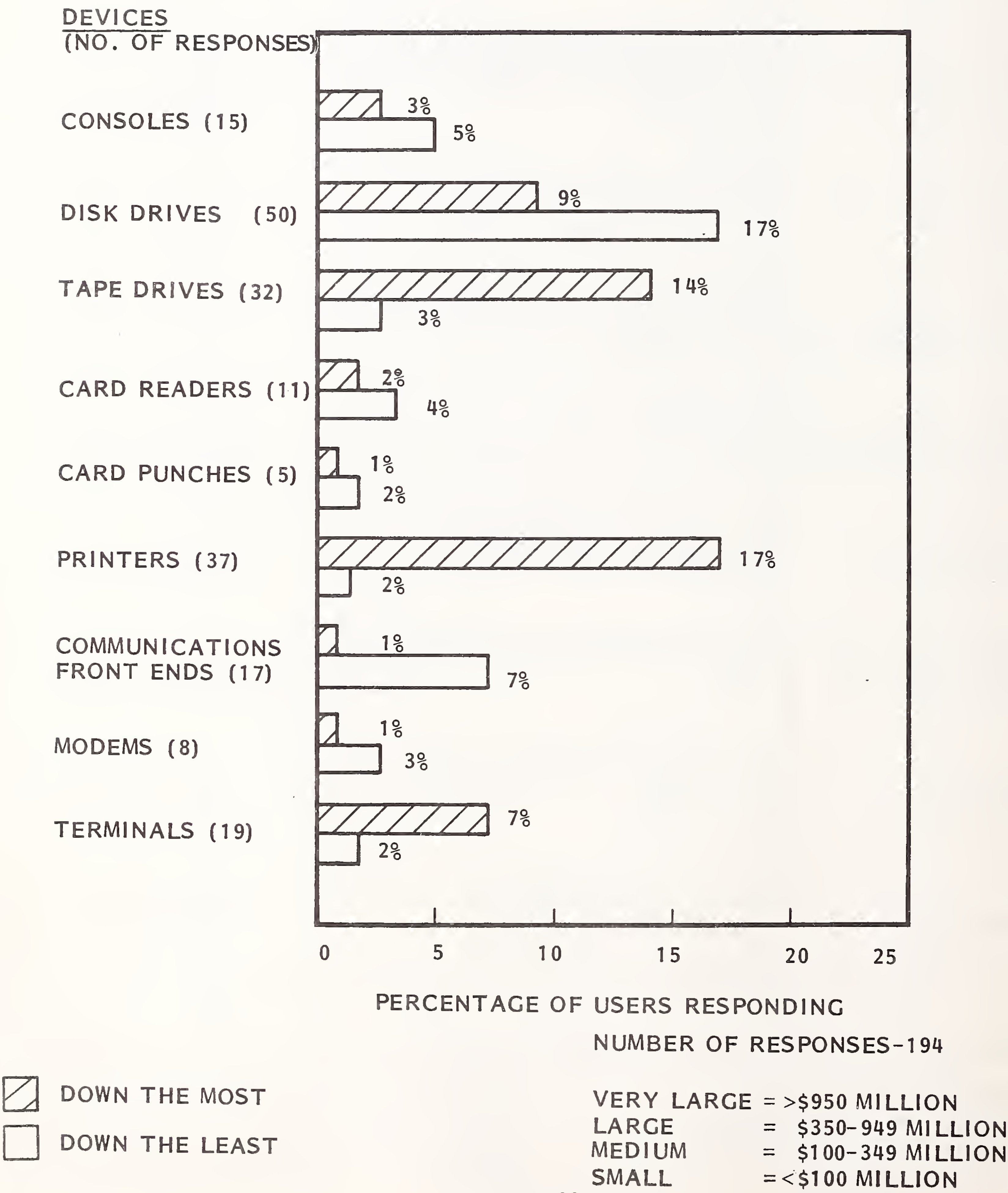
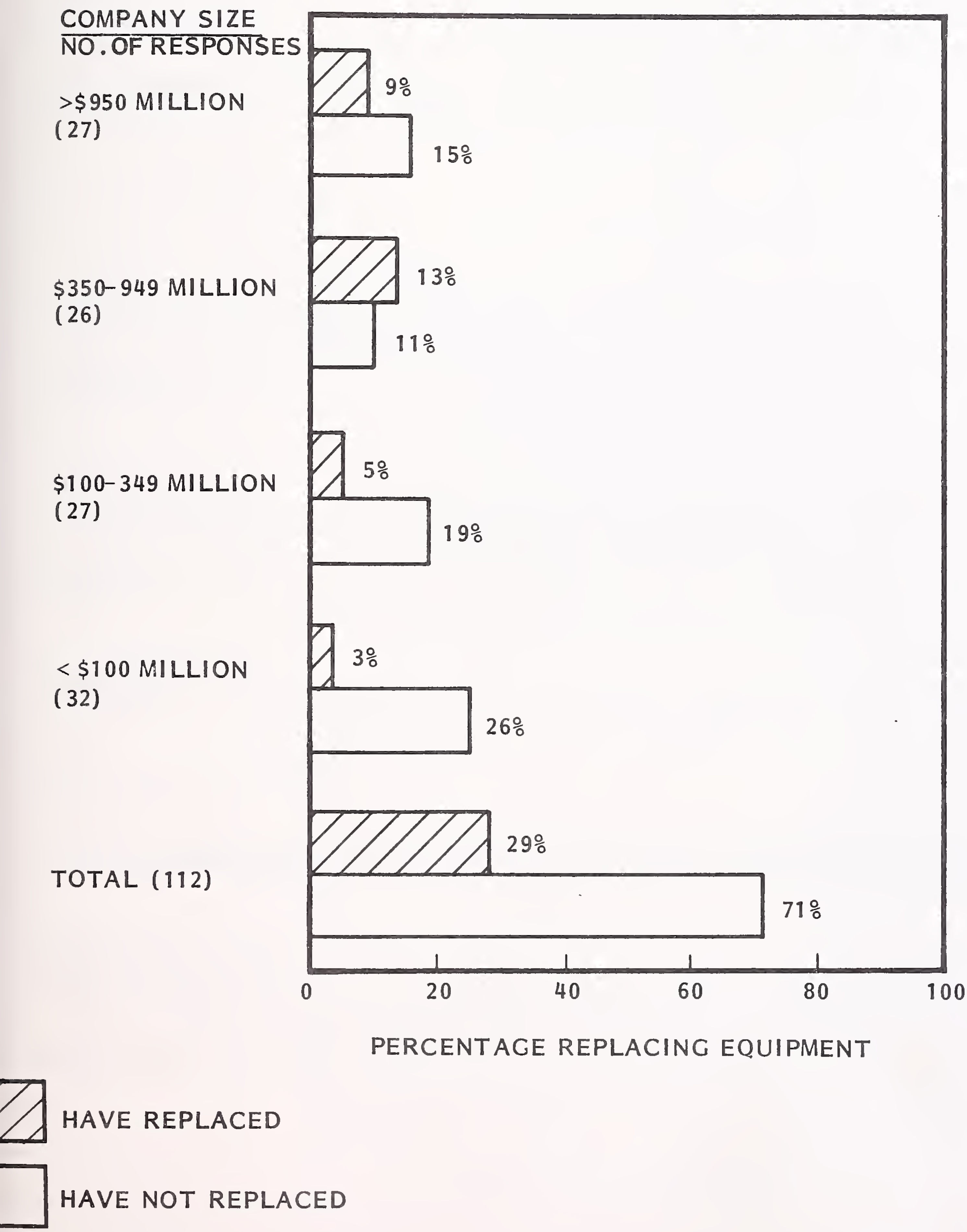


EXHIBIT IV-32

RESPONDENT USERS' REPLACEMENT OF EQUIPMENT
DUE TO DOWNTIME IN THE PAST TWO YEARS



- Primarily, users took action on electro-mechanical devices which are the units perceived by the users to be down the most; e.g., tapes and printers (see Exhibit IV-33).

- Users also replaced disk files which, although down very little, were rated very disruptive when out of service.

- Users reported the availability (i.e. "up-time") of the replacement units was greater than the displaced units.

- Users resist replacing problem equipment.

  - Mainframes are least likely to be replaced due to poor maintenance service. Users do not want to assume the reprogramming effort except as a last resort. Usually users will not replace mainframe units until a capacity upgrade is required.

  - The individual who selected the hardware is often the same person who must make the decision to have it removed. This action belies the judgement of the initial procurement decision and requires extensive justification to establish a "change in circumstance."

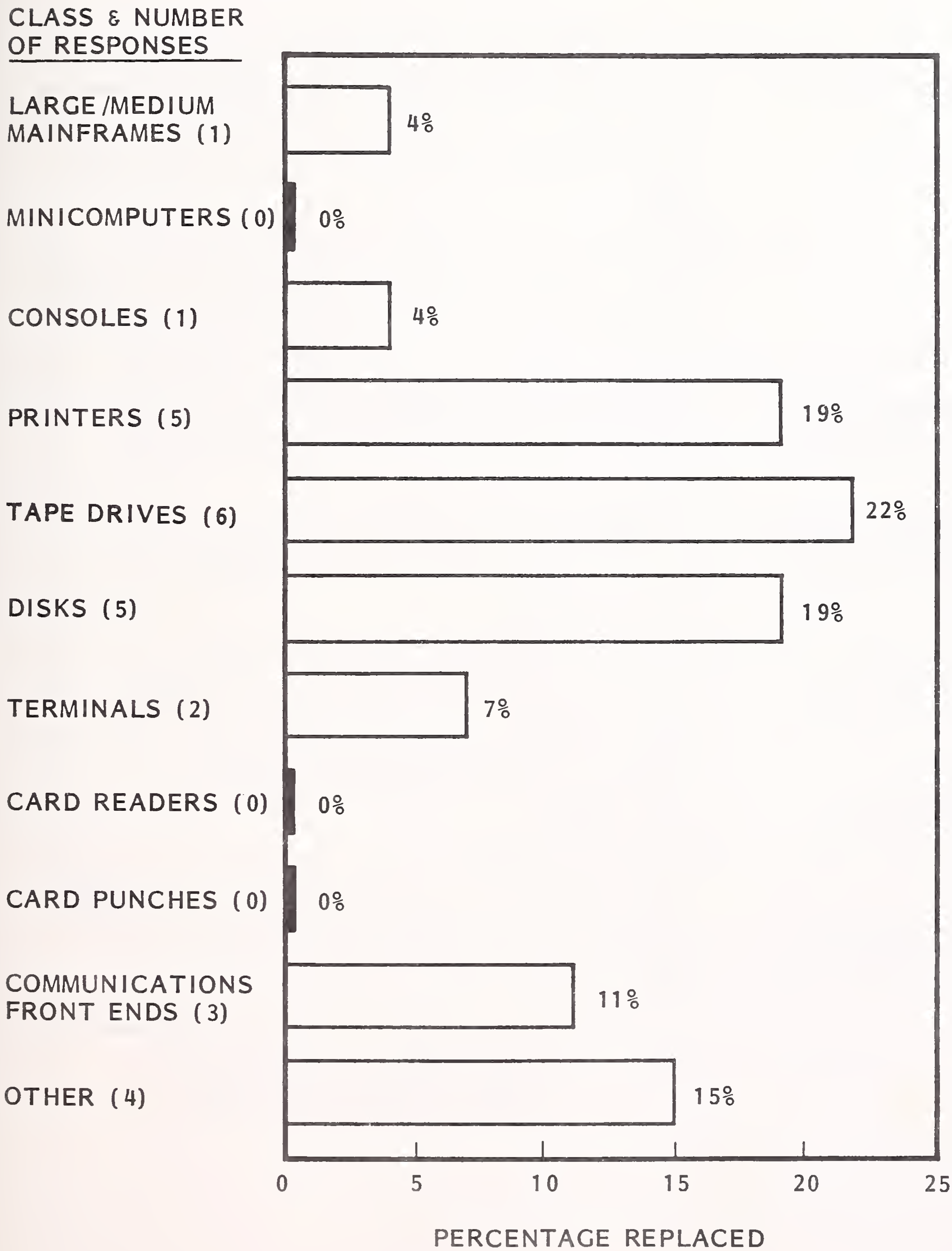
  - New management, not involved in the initial procurement decision, is more likely to replace the units for poor maintenance.

H. USER PREFERENCES CONCERNING PERSONNEL AND PRACTICES

- Respondent users reported no preference between male or female field maintenance engineers (see Exhibit IV-34). However, users tended to believe that males were more experienced in service since females are newer to the field.

EXHIBIT IV-33

RESPONDENT USERS' REPLACEMENT OF EQUIPMENT
DUE TO DOWNTIME IN THE PAST TWO YEARS
BY (EXPANDED) CLASS OF EQUIPMENT

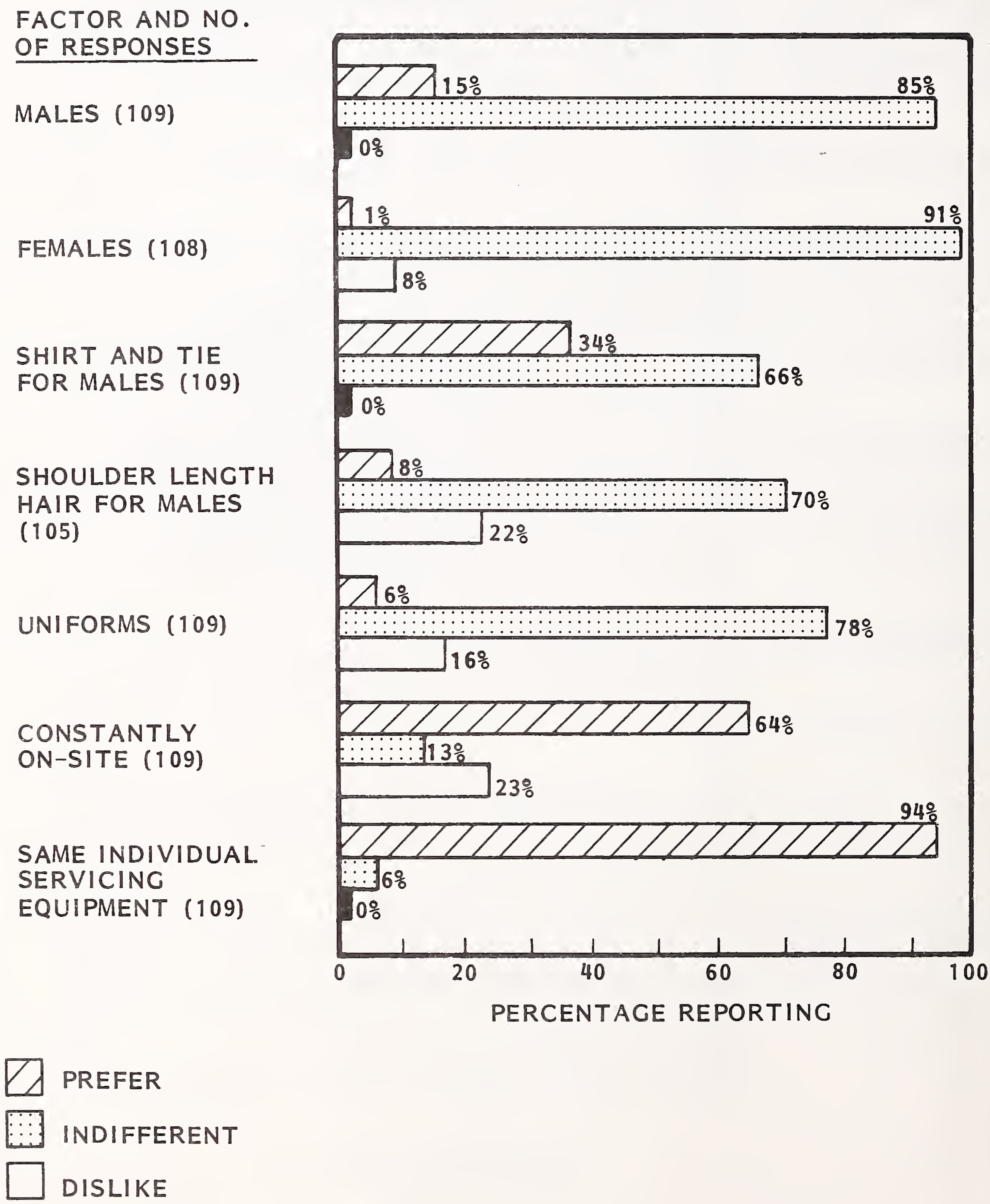


NUMBER OF RESPONSES-27

EXHIBIT IV-34

RESPONDENT USERS' PREFERENCE TOWARDS

MAINTENANCE PERSON'S CHARACTERISTICS



- Users also stated indifference as to a dress code, uniforms or grooming habits. Some geographical preferences appeared in these responses (e.g., more formal business attire was preferred in the Midwest and the South, whereas the West Coast respondents were more casual).

- User attitudes suggested that compared to hardware repair dress codes are unimportant. However, once good service is attained, stricter dress codes were considered to be desirable.

I. NEEDS OF THE USER THAT ARE NOT BEING SATISFIED

- Respondent users had very few needs that were not being satisfied at present nor did they suggest any unique methods to improve service (see Exhibits IV-35 and IV-36).

- Users are generally satisfied with the present service effort. However, they perceive that:

  - The overall quality of service has deteriorated in the past two years.

  - Service will deteriorate further and they are concerned about maintainability of complex systems.

  - The shortage of spare parts is, in many cases, reaching critical levels.

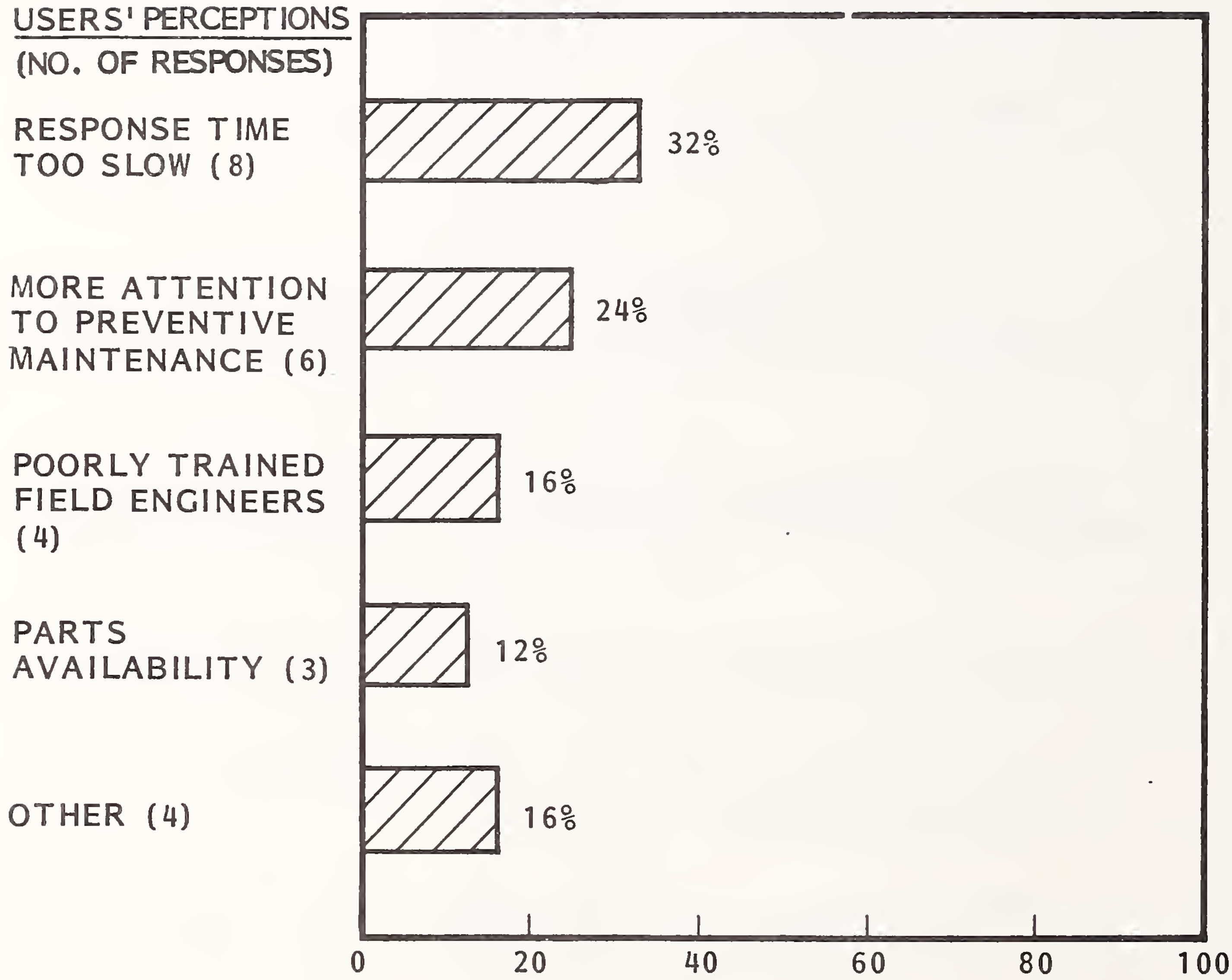
  - Newer field engineers are not properly trained and/or they lack the skills to comprehend the training received.

  - There is currently a shortage of qualified field engineers and response time is prolonged due to staffing levels.

EXHIBIT IV-35

RESPONDENT USERS' PERCEPTIONS OF SERVICE

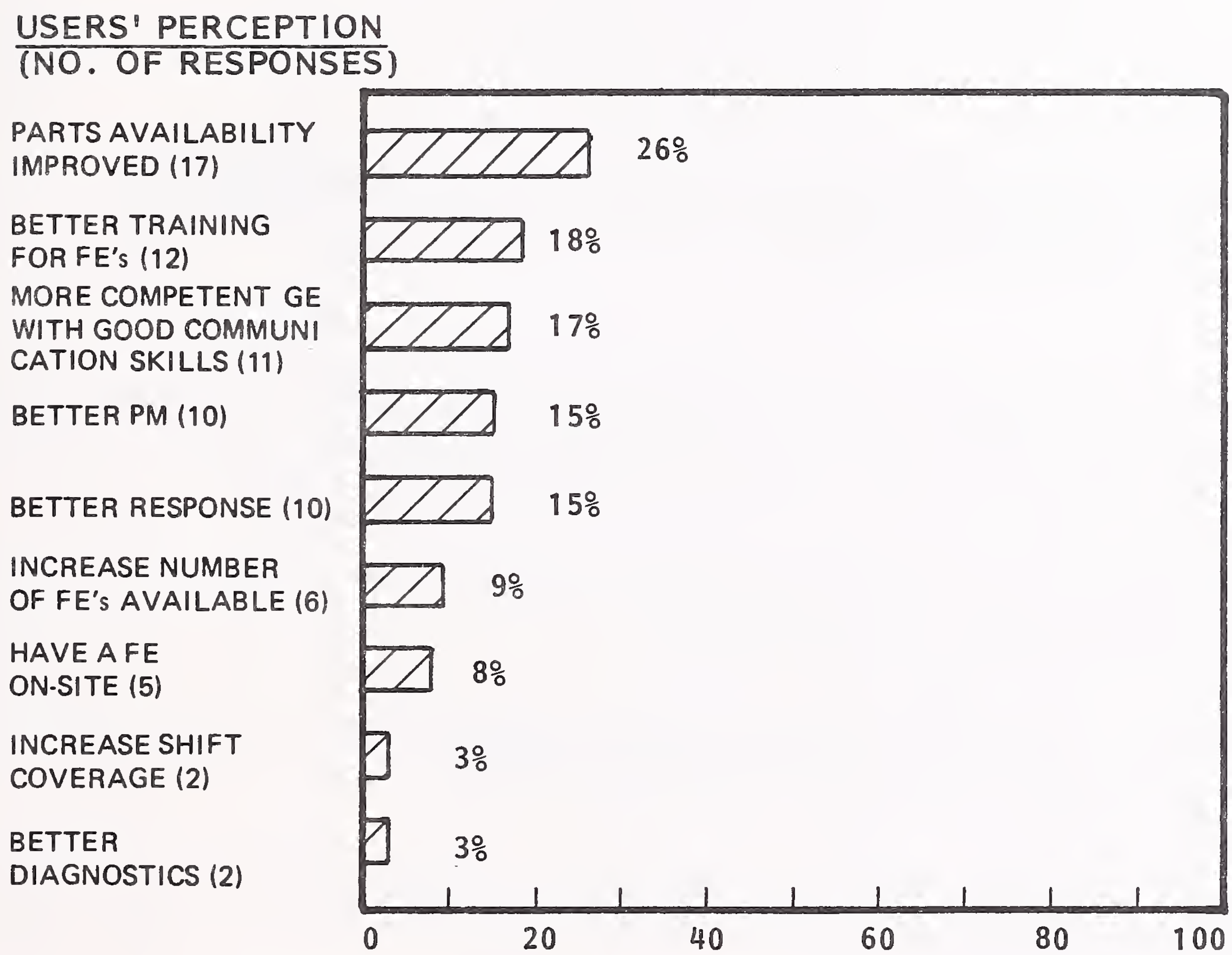
NEEDS NOT NOW BEING SATISFIED



NUMBER OF RESPONSES-25

EXHIBIT IV-36

RESPONDENT USERS' PERCEPTION OF MEANS TO IMPROVE SERVICE



NUMBER OF RESPONDENTS-75

- The newer field engineers require more training in public relations and communication skills; e.g., reporting in on arrival and out when completed with a definition of the problem discovered and the status of the repair.

- Preventive maintenance, if required, is not given proper attention by the vendors; e.g., schedules are established for P.M. and the service person doesn't arrive or call to cancel.

J. USER PREFERENCE FOR CONTRACT OR TIME AND MATERIAL MAINTENANCE SERVICE

- Only 2.6% of respondent users reporting for all classes of installed equipment preferred time and material as opposed to an annual maintenance contract (see Exhibit IV-37).

- Respondent users perceive that:

  - Maintenance contracts are less expensive than time and material based upon reliability of the present hardware.

  - Resale value of the hardware is enhanced if it has been properly maintained.

  - Some third party lessors require manufacturer maintenance contracts and therefore the equipment's residual value must be improved.

  - The quality of service rendered under a maintenance contract is better than that provided under a time and materials agreement.

  - The maintenance vendor is more concerned about reducing service calls under a maintenance contract than he is on time and material.

EXHIBIT IV-37

RESPONDENT USERS' PREFERENCE FOR CONTRACT OR TIME AND MATERIAL MAINTENANCE SERVICE

EQUIPMENT CLASSIFICATION	VERY LARGE > $950M		LARGE $350-949M		MEDIUM $100-349M		SMALL < $100M	
	T/M	CON-TRACT	T/M	CON-TRACT	T/M	CON-TRACT	T/M	CON-TRACT
LARGE AND MEDIUM MAINFRAMES	1	34	0	28	0	19	2	25
SMALL BUSINESS COMPUTERS	0	9	0	8	2	7	0	13
OTHER MINICOMPUTERS	0	14	0	8	0	1	0	8
PLUG COMPATIBLE PERIPHERALS	1	36	0	18	0	17	1	18
TERMINALS	0	36	0	27	2	21	1	22
TOTAL	2	129	0	89	4	65	4	86

NUMBER OF RESPONSES-108

- The cost of major spare parts offsets any financial gain of time and material versus maintenance contract.

- The maintenance contract is an insurance policy against major repair costs.

K. USER MAINTENANCE COVERAGE REQUIREMENTS

- Only 35% of respondent vendors had limited their maintenance coverage offerings to one shift five days a week (see Exhibit IV-38).

- Most users with a one shift requirement today were anticipating expansion to multiple shifts by 1980, with the exception of small users requiring less systems time for the operation of their business.

- Users state that in spite of the staffing problems, multi-shift utilization is necessary due to the increased utilization of communications.

  - Communication line charges are greatly reduced during non-business hours.

  - Geographic dispersement of terminals across time zones require shift changes and extra shift utilization.

L. USER STATUS ON AND PLANS FOR DISTRIBUTED DATA PROCESSING

- Thirty-four percent of the respondent users currently have distributed data processing (DDP) installed and an additional 27% plan implementation of DDP by 1980 (see Exhibit IV-39 and IV-40).

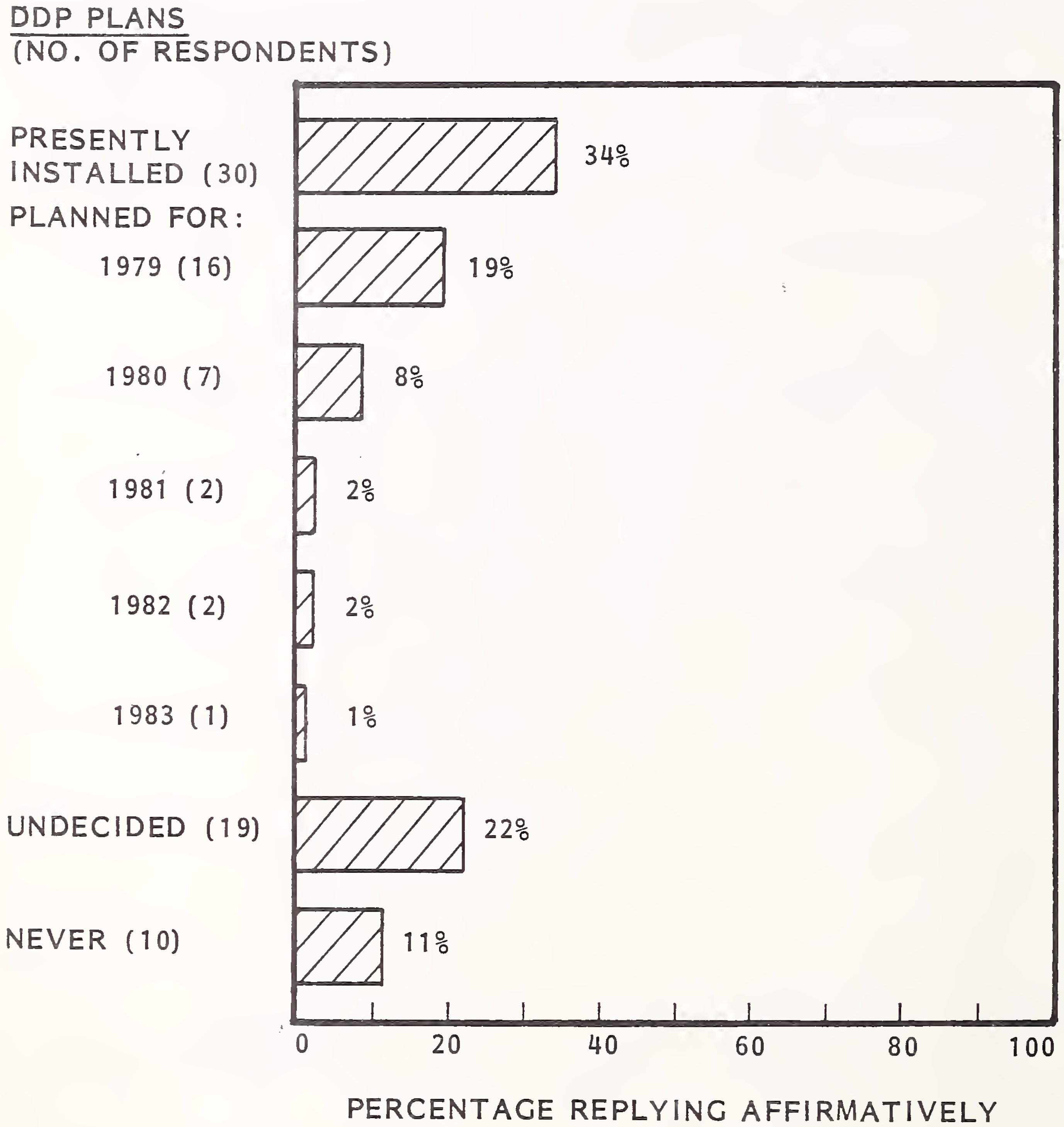
EXHIBIT IV-38

RESPONDENT USERS' MAINTENANCE COVERAGE REQUIREMENTS

MAINTENANCE COVERAGE	VERY LARGE	LARGE	MEDIUM	SMALL	TOTAL RE-SPONSES	PERCENT OF TOTAL
ONE SHIFT/FIVE DAYS	7	12	8	19	46	35%
ONE SHIFT/SIX DAYS	3	3	3	1	10	8
ONE SHIFT/SEVEN DAYS	1	0	2	0	3	2
TWO SHIFTS/FIVE DAYS	0	1	4	3	8	6
TWO SHIFTS/SIX DAYS	0	2	0	0	2	2
TWO SHIFTS SEVEN DAYS	1	0	0	0	1	1
THREE SHIFTS/FIVE DAYS	3	5	3	2	13	10
THREE SHIFTS/SIX DAYS	5	3	2	1	11	8
THREE SHIFTS/SEVEN DAYS	13	8	10	8	39	29
TOTAL RESPONSES	33	34	32	34	133	100%

EXHIBIT IV-39

PERCENTAGE OF RESPONDENT USERS
WHO HAVE PLANS FOR DISTRIBUTED DATA PROCESSING



NUMBER OF RESPONDENTS-87

EXHIBIT IV-40

RESPONDENT USERS' PLANS FOR DISTRIBUTED DATA PROCESSING

SITUATION	NUMBER OF AFFIRMATIVE RESPONSES					PERCENTAGE OF AFFIRMATIVE RESPONSES				
	VL	L	M	S	TOTAL	VL	L	M	S	TOTAL
PRESENTLY INSTALLED	11	4	8	7	30	13%	5%	9%	8%	34%
PLANNED FOR: 1979	3	4	4	5	16	3	5	5	6	19
1980	2	4	1	0	7	2	5	1	0	8
1981	1	0	1	0	2	1	0	1	0	2
1982	2	0	0	0	2	2	0	0	0	2
1983	0	1	0	0	1	0	1	0	0	1
UNDECIDED	3	2	6	8	19	4	2	7	9	22
NEVER	1	2	2	5	10	1	2	2	6	11
TOTAL	23	17	22	25	87	26%	20%	25%	29%	100%

- Users interviewed in both this and other INPUT studies indicate the desire for distributed data processing consider:

  - A method to offload the mainframe and to slow the rate of mainframe upgrades.

  - A method to facilitate decentralization while maintaining centralized EDP control.

  - A means for remedying remote user dissatisfaction with the timeliness of centralized reporting.

- Vendors are well aware of the growing DDP trend and perceive:

  - Further geographic dispersion of computing power.

  - Computer systems under the control of less trained personnel.

  - The requirement to provide both hardware and software support in remote areas.

- Respondent users are concerned about:

  - Adequate personnel to design and install complex communications systems.

  - Availability and structure of useable data bases.

  - Quality of service from common carriers; e.g., service response and repair capability improved over present levels is required -- will it be delivered?

  - Capability of the maintenance vendor to provide remote coverage for hardware and software.

M. USERS' SCHEDULE FOR PREVENTIVE MAINTENANCE AND COST SAVINGS REQUIRED TO ELIMINATE

- Respondent users are confused on the issue of preventive maintenance (see Exhibit IV-41).

  - Users have been sold on preventive maintenance by the vendor as a method to reduce unscheduled service interruptions.

  - Eighty percent of respondent users would not eliminate preventive maintenance.

  - Respondent users indicated that the majority would eliminate PM if so recommended by the vendor.

  - Fifty-three percent of respondent users had PM performed on the prime shift. Users desire to have this time returned for productive use if PM is not required (see Exhibit IV-42).

  - Respondent vendors perceive that if PM was as important as vendors state, the established schedules would be met.

  - Users perceive that PM may not be as important as the vendor states but release the equipment "just in case it may help."

  - Users perceive that allowing PM removes an excuse on the part of the vendor for excessive downtime.

  - Users of small business systems were most vocal on not releasing the machine for PM as the time was required for productive use.

EXHIBIT IV-41

COST SAVINGS REQUIRED FOR RESPONDENT USERS TO ELIMINATE PREVENTIVE MAINTENANCE

RESPONDENTS' REACTIONS	SIZE OF COMPANY				TOTAL
	VERY LARGE	LARGE	MEDIUM	SMALL	
WOULD NOT ELIMINATE	21%	17%	17%	25%	80%
WOULD FOR 5% OF CONTRACT COST	0	0	0	2	2
WOULD FOR 5-10% OF CONTRACT COST	0	1	3	2	6
WOULD FOR 11-20% OF CONTRACT COST	0	1	2	1	4
WOULD FOR 21-30% OF CONTRACT COST	2	1	1	0	4
WOULD FOR >30% OF CONTRACT COST	1	2	0	1	4
TOTAL	-	-	-	-	100%

EXHIBIT IV-42

RESPONDENT USERS' SCHEDULE FOR
PREVENTIVE MAINTENANCE

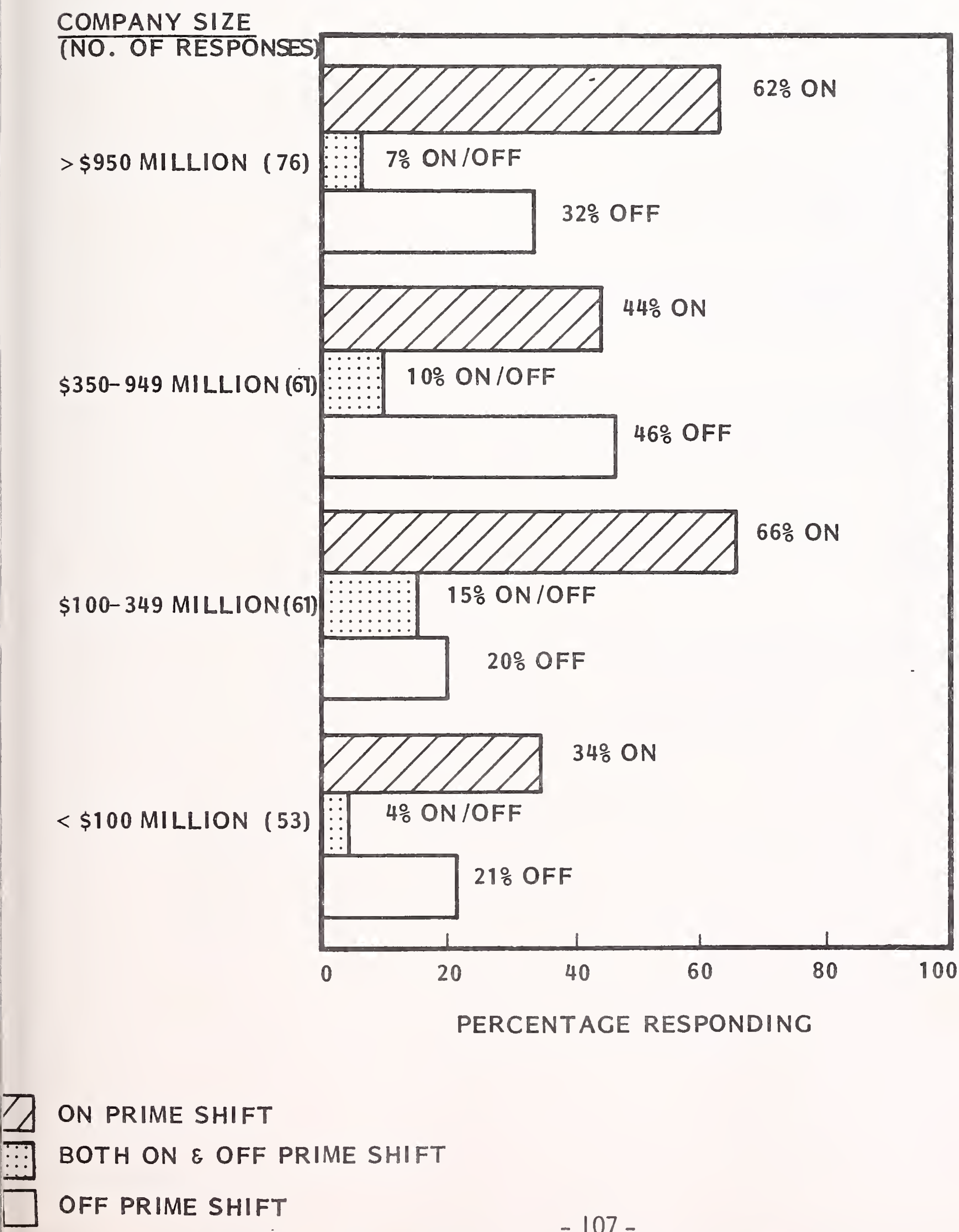
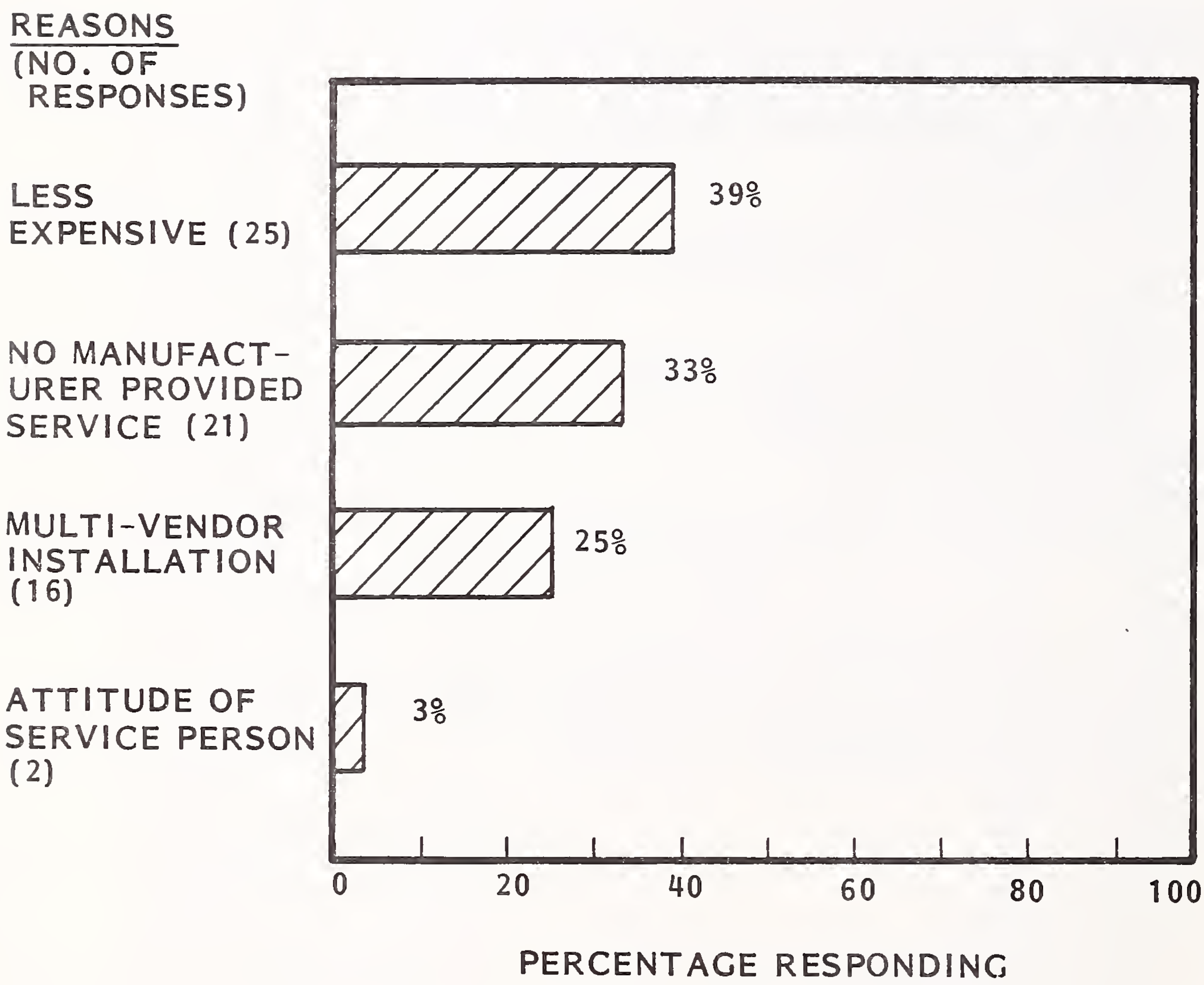


EXHIBIT IV-43

REASONS FOR RESPONDENT USERS' CONSIDERATION OF UTILIZING THIRD PARTY MAINTENANCE SERVICE



NUMBER OF RESPONDENTS-64

- Some users expressed a concern that PM caused equipment problems and preferred to have PM done only as part of an unscheduled service call.

N. REASONS FOR USERS' CONSIDERATION OF UTILIZING THIRD PARTY MAINTENANCE SERVICE AND REPORTED COST SAVINGS

- Reasons for users considering the utilization of third party maintenance is analyzed in Exhibit IV-43:

  - Thirty-nine percent of the users reported third party maintenance was less expensive. Of the 26 responding users, 13 reported savings of 24% or less and 13 reported savings of 25% or more (see Exhibit IV-44).

  - Thirty-three percent reported that no service was provided by the manufacturer due to geographic location of the equipment or because the manufacturer was no longer in that business.

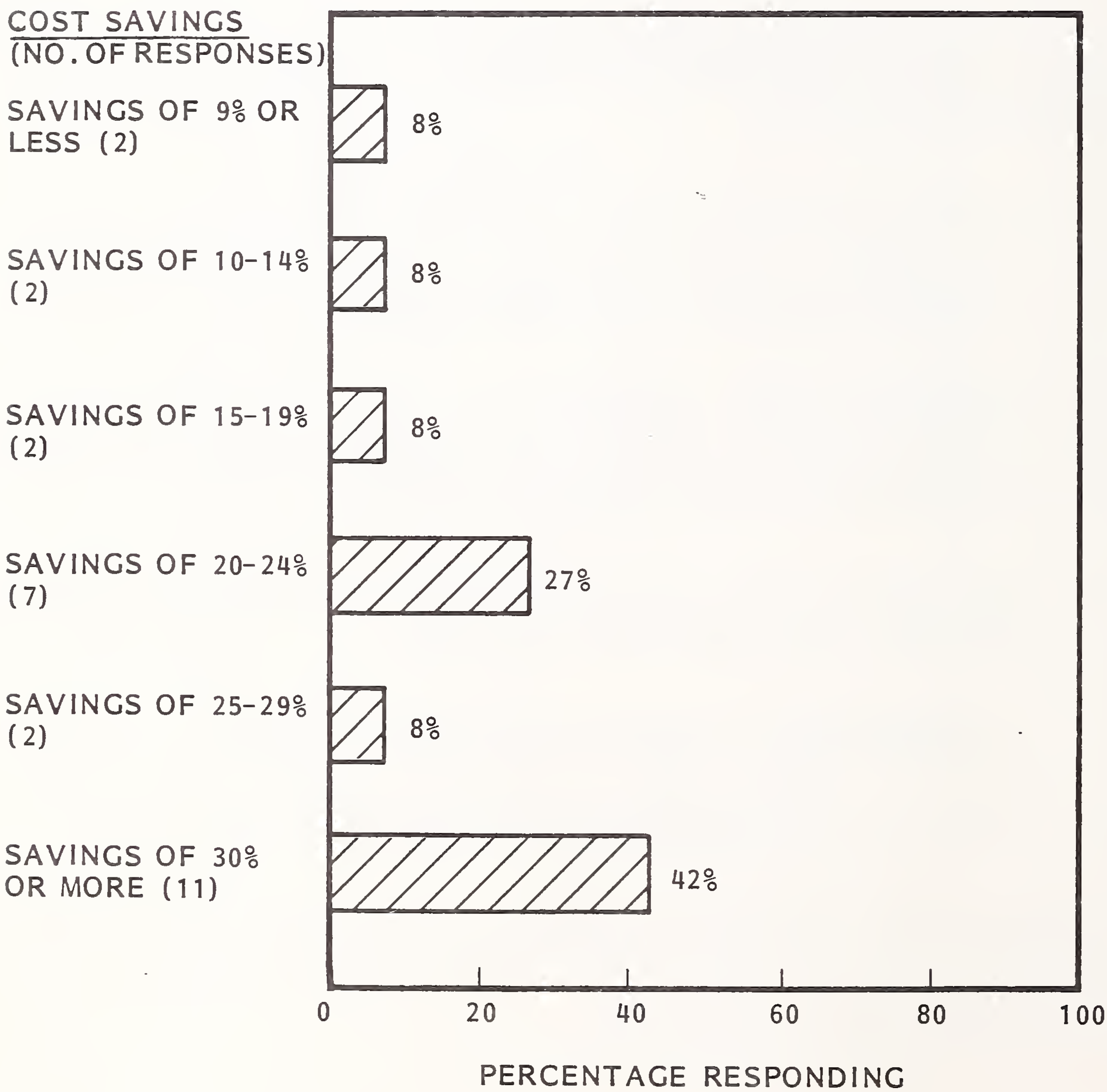
  - Third party market penetration was greater in the medium and small firms than in the large and very large users.

  - Twenty-five percent of the users considered third party maintenance because of a multi-vendor installation; i.e., no single hardware vendor would assume the maintenance task for hardware supplied by others.

- Respondent users (17.9%) reported some utilization of third party maintenance service and respondent vendors reported that 17.1% of their equipment was maintained by third party companies.

EXHIBIT IV-44

PERCENTAGE COST SAVINGS REPORTED BY RESPONDENT USERS FOR THIRD PARTY VS. MANUFACTURER SUPPLIED MAINTENANCE



NUMBER OF RESPONSES-26

O. USERS' PERCEPTION OF MAINTENANCE REQUIREMENTS FOR AUTOMATED OFFICE AND PABX EQUIPMENT

- Respondent users were asked if the maintenance characteristics for automated office equipment and private automation branch exchange were similar to the requirements for information processing (see Exhibit IV-45).

  - Forty-six percent of the respondent users want similar maintenance characteristics for automated office equipment citing:

    . Word processing and its utilization of minis, micros, CRTs and communications.

    . Teletype equipment used for administrative message processing and its similarities to a hard copy terminal.

  - Thirty-two percent of the respondent users want equivalent maintenance coverage for PABX citing:

    . Utilization of minis with programming capability as a base for the newer electronic switchboards.

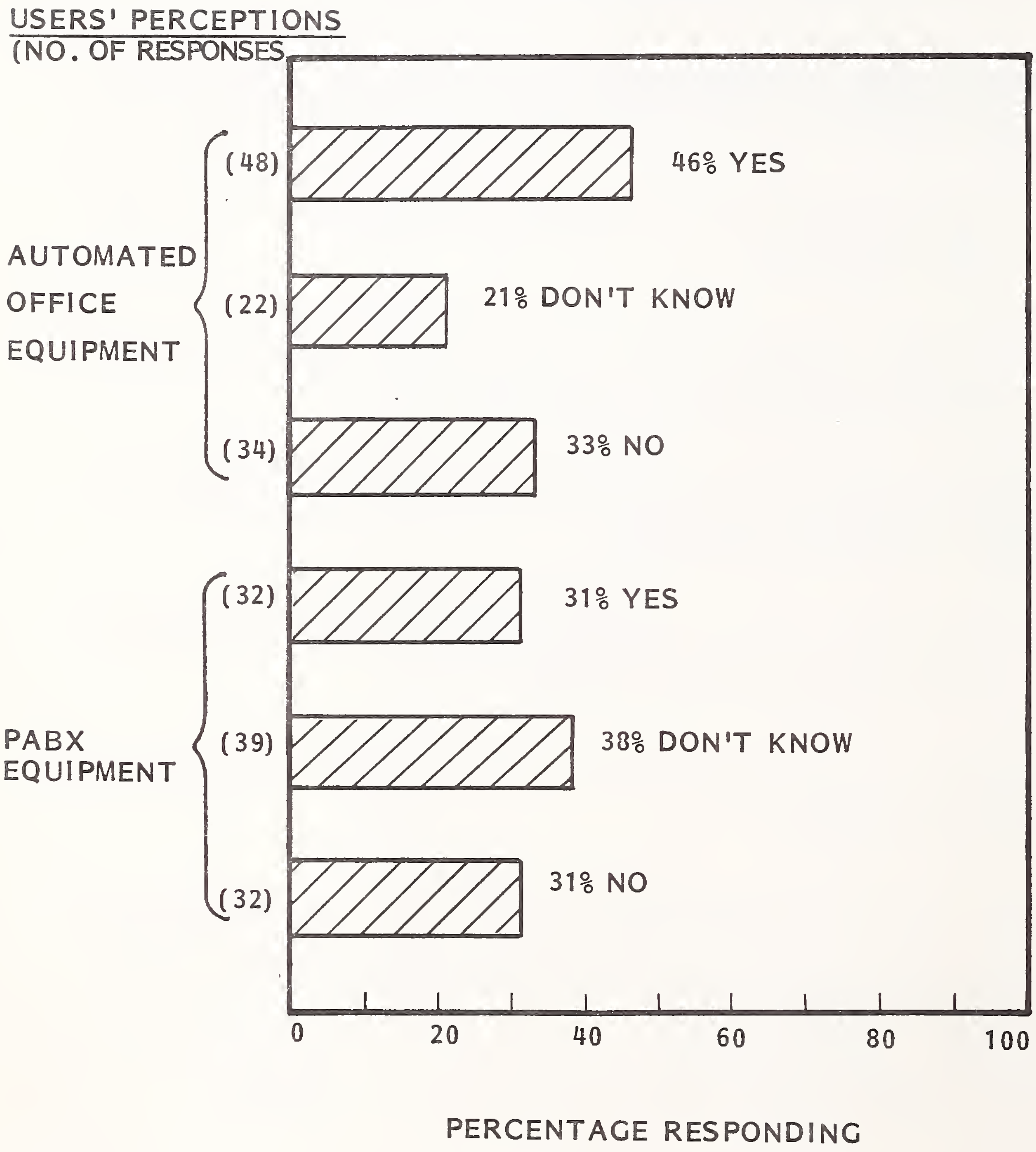
- Twenty percent of the respondent users had no knowledge of maintenance requirements for either area.

- Functions that heretofore were considered to be non-information processing oriented are changing in character and becoming more aligned with the computer industry. There is really very little difference in maintenance requirements for a minicomputer that is functioning as a switchboard or as a word processor to a small business computer that is preparing payroll.

- Future trends reflect a change in user stance on maintenance due to:

EXHIBIT IV-45

RESPONDENT USERS' PERCEPTIONS OF MAINTENANCE CHARACTERISTICS FOR OTHER THAN INFORMATION PROCESSING



- Utilization of computing devices in office and switchboard applications.

- Increasing costs of maintenance.

- Multiple vendors servicing equipment that is similar in form.

- While not apparent in the survey results, it is conceivable that similar maintenance characteristics could lead large users to the:

  - Creation of an in-house maintenance force for all equipment.

  - Appointment of a maintenance "czar" to assure reliable, timely, and cost effective service.

P. USER COMMENTS

- Respondent users commented on various aspects of their maintenance relationships with the vendor, and following are a few that are representative:

  - On the subject of mean time to repair:

    - "Difficult to distinguish between mean time to respond and mean time to repair as to which is the most important. However, we need response to see if there is a problem."

    - "All I care about is how long it takes to get the system up and running."

    - "My contract says two hour response time. They feel that a phone call one hour and 59 minutes later to tell me when I can expect an F.E. is responding--I don't."

- "Our biggest hang-up is response, in-person not via phone."

- "Sure I want response but I also feel like an ass when the customer engineer shows up and it's an operation problem. It's like 'crying wolf' and when you need them they think it's another false alarm."

- On the subject of preventive maintenance:

  - "If they stopped PM I would leave this company."

  - "PM works - I wish they would do a better job."

  - "Let them pull PM when the system is down due to a failure. If it runs leave it alone."

  - "The less the maintenance people have their hands on my equipment, the less chance they have of breaking it."

- On the subject of maintenance cost:

  - "The problem is that we are not getting what we were promised, we would not accept an increase."

  - "We would not pay more for the present level of service. If we got the response the vendor promised them an 8-10% increase would be OK."

  - "How can they commit to a level of service, not deliver and raise prices?"

  - "Prices are going up and service quality is down. Same is true with most items you buy."

- "We would pay almost any price to keep our equipment up."

- "Maintenance costs are pennies compared to the hardware and the people waiting on it to get fixed."

- On the general subject of maintenance:

  - "The quality of the people has slipped."

  - "The F.E.s are not as good as they once were and they don't care."

  - "Account management is a fake. The regional manager was here and told me to call if I needed help. Two days later he acted like he never met me."

  - "I don't want the first level manager here, the rest are useless. They can't fix anything why should they come here."

  - "If you (as a user) try, account management works."

  - "They use the customer satisfaction survey I fill out. They even called and followed up."

  - "Our repair service is poor due to lack of parts."

  - "Hard to say which is worse--the lack of parts or the level of the service people."

  - "Our vendor won't admit it but he is out of a lot of spares."

  - "I have five vendors and they are all short of spares."

V RESULTS OF THE INFORMATION PROCESSING INDUSTRY VENDOR SURVEY

V RESULTS OF THE INFORMATION PROCESSING INDUSTRY VENDOR SURVEY

A. THE PROCUREMENT, TRAINING AND COMPENSATION OF MAINTENANCE PERSONNEL

1. PROJECTION OF FIELD ENGINEERING GROWTH, 1978-1983

- Exhibit V-1 reflects an AAGR in respondent vendors' field engineering staffing of 15.3% for 1978-1983.

  - Lowest growth during this period is reported by the mainframe vendors (9.2% AAGR) resulting from an anticipated increase of installation density.

  - Conversely, through the advent of distributed data processing, the growth of terminal installations in remote locations resulted in a forecasted AAGR for field engineer requirements of 29% from 1978-1983 by the vendors interviewed.

- Estimates placed total U.S. 1977 field engineers at 79,500 and 1978 field engineering employment at 90,000 (11.7% increase).

EXHIBIT V-1

RESPONDENT VENDOR PROJECTED INCREASE IN FIELD ENGINEERS THROUGH 1983 BY VENDOR TYPE

TYPE OF VENDOR (NO. OF RESPONSES)	1977	1978	% CHANGE IN-CREASE	1979		1980		1981		1982		1983		AAGR (1978-1983)
	BASE	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	
MAINFRAMES (5)	12,030	12,820	6.1%	13,789	7.6%	14,885	8.0%	16,253	9.2%	17,945	10.4%	19,879	10.8%	9.2%
SMALL BUSINESS COMPUTERS (3)	143	279	95.1	382	-	505	-	665	-	877	-	1,156	-	19.3
MINICOMPUTERS (5)	738	867	17.5	1,020	17.7	1,202	17.9	1,382	15.0	1,562	13.0	1,738	11.3	15.0
PERIPHERALS (8)	776	899	15.9	1,112	23.7	1,362	22.5	1,667	22.4	2,067	24.0	2,566	24.1	23.3
TERMINALS (6)	713	971	36.2	1,375	41.6	1,723	25.3	2,154	25.0	2,695	25.1	3,524	30.8	29.4
THIRD PARTY MAINTENANCE (5)	3,316	3,750	13.1	4,187	11.7	5,002	19.5	5,975	19.5	7,241	21.2	8,827	21.9	18.7
OTHER (9)	995	1,310	31.7	1,809	38.1	2,322	28.4	2,969	27.9	3,800	28.0	4,868	28.1	30.0
ALL VENDORS COMBINED	18,711	20,896	11.7%	23,674	13.3%	27,001	14.1%	31,065	15.1%	36,187	16.5%	42,558	17.6%	15.3%

- Including field management, training headquarters staff and technical support, the total maintenance headcount of the respondent vendors is 26,614 with a direct field engineering force of 20,896 or 21.6% of the estimated universe of 90,000 (see Exhibit V-2).

  - Respondent vendors reported one field manager for 9.6 field engineers and one support person per 3.6 field engineers, when field managers were counted as support.

- Respondent vendor field engineers increased 10.5% in 1978 over 1977 while the universe increased 11.7%. Growth was slower with the respondent vendors due to a variety of reasons including:

  - Inclusion of large companies which have productivity rather than personnel increases to handle additional workload.

  - Conversion of work force from electro-mechanical devices to electronics; therefore, one field engineer can produce more revenue and maintain more units.

- Reconciliation: respondent vendors reported 14.8% new hires for the total maintenance organization and an attrition rate of 7.1%.

  - The net difference between 14.8% new hires and 7.1% attrition equals 7.7% net addition.

  - Subtracting the 7.7% net employment gain from the 10.5% reported expansion equals 2.8% increase of the total maintenance organization from a source other than new hires.

  - Respondent vendors report this additional 2.8% increase was derived from internal sources and while new to field maintenance were not considered new hires. This float amounts to a variance of 634 people.

EXHIBIT V-2

TOTAL RESPONDENT VENDORS' MAINTENANCE ORGANIZATION BY TYPE OF VENDOR

TYPE OF VENDOR (NO. OF RESPONDENTS)	FIELD ENGINEERS		FIELD MANAGERS		ADMINIS-TRATORS		TOTAL PERSONNEL	
	NO.	%	NO.	%	NO.	%	NO.	%
MAINFRAME (5)	12,820	81.8%	1,243	7.9%	1,607	10.3%	15,670	100%
SMALL BUSINESS COMPUTER (3)	279	58.6	28	5.9	169	35.5	476	100
MINICOMPUTER (5)	867	74.4	125	10.7	173	14.9	1,165	100
PERIPHERAL (8)	899	68.3	109	8.3	309	23.4	1,317	100
TERMINAL (6)	971	67.6	133	9.3	332	23.1	1,436	100
THIRD PARTY MAINTENANCE (5)	3,750	77.9	385	8.0	677	14.1	4,812	100
OTHER (9)	1,310	75.4	145	8.3	283	16.3	1,738	100
TOTAL (41)	20,896	78.5%	2,168	8.1%	3,550	13.4%	26,614	100%

- The maintenance personnel projection includes information processing companies but excludes communications carriers and PABX suppliers.

2. PRESENT AND FUTURE SOURCES FOR HIRING FIELD ENGINEERS

- The greatest maintenance problem reported by the respondent vendors is attracting qualified personnel in quantities sufficient to meet the present and forecasted needs. Exhibit V-3 describes the sources that are used by vendors in hiring field engineers.

- Traditional sources for recruiting field engineers (e.g., trained discharged armed forces personnel) have disappeared.

  - The conversion from a draft dependent military force to an all volunteer service base has reduced the flow of trained electronic technicians formerly available. The services are not training electronic technicians in depth, nor is the discharge rate as high as previously.

  - Under a draft system, a cross section of the entire population was represented. The mix of recruits has changed and developing qualified electronic technicians is difficult due to the level of the raw material available.

  - Some qualified retirees are available but this source will be short lived.

  - The armed forces have reduced their technical support requirements to functional unit or "box" replacements rather than the total system repair concept.

- The major source today for field engineers is recruiting from competition.

  - Not all vendors are vulnerable to competitive hiring practices. Companies that create an engineering environment are able to attract and hold field engineers. This environment is defined as one of a "profes-

EXHIBIT V-3

SOURCE OF FIELD ENGINEERS IN 1978 AND 1982 FOR RESPONDENT VENDORS

VENDOR SOURCE OF PERSONNEL	1978							1982						
	1978 RANKING	RATING 1978					TOTAL RESPONSES	1982 RANKING	RATING 1982					TOTAL RESPONSES
		5	4	3	2	1			5	4	3	2	1	
HIRE AND TRAIN (NO TECHNICAL PRETRAINING)	-	3	7	1	5	26	42	4	13	2	1	3	16	35
RECRUIT FROM COMPETITION	5	17	8	10	6	10	56	-	5	7	9	11	7	39
RECRUIT FROM INDUSTRIES	-	5	5	9	9	20	48	3	3	6	12	9	9	39
TRAINED DISCHARGED ARMED FORCES PERSONNEL	3	7	5	14	9	11	49	-	2	5	13	2	15	37
RECRUIT FROM OTHER FUNCTIONS WITHIN THE COMPANY	-	4	5	9	9	19	46	-	5	4	9	7	12	37
TRADE SCHOOLS	4	14	10	5	7	12	52	5	19	12	4	3	3	41

KEY: 5 = HIGH RATING, 1 = LOW RATING

sional engineering atmosphere" where the job is viewed by corporate management as equal in importance to marketing or engineering. This importance of the individual in his job performance is communicated, in deeds and actions, by corporate management to the individual as well as to his peer groups.

- Trade schools are the emerging source for trained people.

  - The quantity of trade school graduates is presently limited and quality will diminish as demand increases.

  - Field engineering is competing for personnel with other industries, other information processing companies, plus their own company's internal requirements for production and quality control.

- Two year college courses have a programming content level that qualifies graduates for software positions which provide better compensation than field engineering.

- Due to the shortage of applicants, unqualified individuals are being hired.

- Future trends will accelerate the present field engineering shortages.

  - The need for field engineers within the information processing industry will continue to grow at a 15.3% AAGR through 1983.

  - Distributed data processing will place more computer equipment in the hands of less trained operators.

  - Distributed data processing will force field engineering to maintain software more frequently.

  - The movement of electronics into the consumer area will further reduce the number of available technicians.

- The number of field engineers leaving the industry has been increasing in quantity. (Note: While specific numbers were not available, an estimated 25% of the separations are for the stated reason of leaving the industry.)

- Vendor comments on sources for hiring field engineers:

  - "The ex-military people are no longer available."

  - "The government has cut the G.I. Bill and ex-servicemen aren't following trade schools."

  - "The government created a free source (i.e., trained armed forces personnel) for people and they took it away."

  - "My company should start a trade school that would do a better job."

  - "Trade schools are needed that specialize in systems such as 370 and 3300."

  - "There should be a trade school that teaches minis."

  - "If I had the money I would start a trade school and aim for special areas."

  - "The industry hasn't done a job in selling field engineering as a career to high schools."

  - "Need to sell service as a career to college counselors."

  - "How many high school or college students do you know that want to be a serviceman?"

- "The industry should support an association to address the hiring problem."

- "When corporate management realizes the shortage projected for 1980, then an association will be formed to solve the problem."

- "Field engineering must solve the problem of hiring and not leave it to personnel which at its best is ineffective."

- "Personnel is just a roadblock, not a help."

- "Personnel isn't going to solve our problems. We are getting our own tech recruiters."

- "Personnel has taken too much of the line authority."

- "We must prove we can handle field engineering hiring better than personnel."

- "If we reacted in the same responsive manner to a new hire as we do a customer problem, we wouldn't be short of new people."

- "We don't move fast enough on an applicant. Personnel slows us down."

- "Hiring people is important but we do a poor job."

- "I don't want to think about 1980, I can't fill today's needs."

- "I am glad some companies won't rehire; it makes my staffing job easier."

- "Times have changed; you now have to sell a person on joining your company."

3. TRAINING OF MAINTENANCE PERSONNEL

- Training needs in consort with projected hiring requirements will continue to increase. The scope of courses offered will be expanded and the dollars spent for training will increase.

- As shown in Exhibit V-4, virtually all vendors interviewed provide a formal field engineering training program for hardware, and about two-thirds currently include or plan to expand the program to include software.

    - New technology will force an increase in training effort.

    - Training will increase in quality and formality.

    - Training will expand to compensate for "less technical" new hires.

    - Training on public relations skills is needed but not being addressed.

- Respondent vendors reported (see Exhibit V-5):

    - An average of 6,283 student days in 1978 with a projected increase of 36.5% for 1979.

    - An average of 9.4 instructors required for 1978 with a projected increase of 37.5% in the number of instructors needed for 1979.

        - This direct linear relationship reveals that very little has been accomplished to modernize teaching techniques and control costs.

    - 32.5% of the respondent vendors reported no increase in student days for 1979 and 45.2% reported no increase of instructors for 1979.

EXHIBIT V-4

FORMAL FIELD ENGINEERING TRAINING PROGRAMS PROVIDED BY RESPONDENT VENDORS

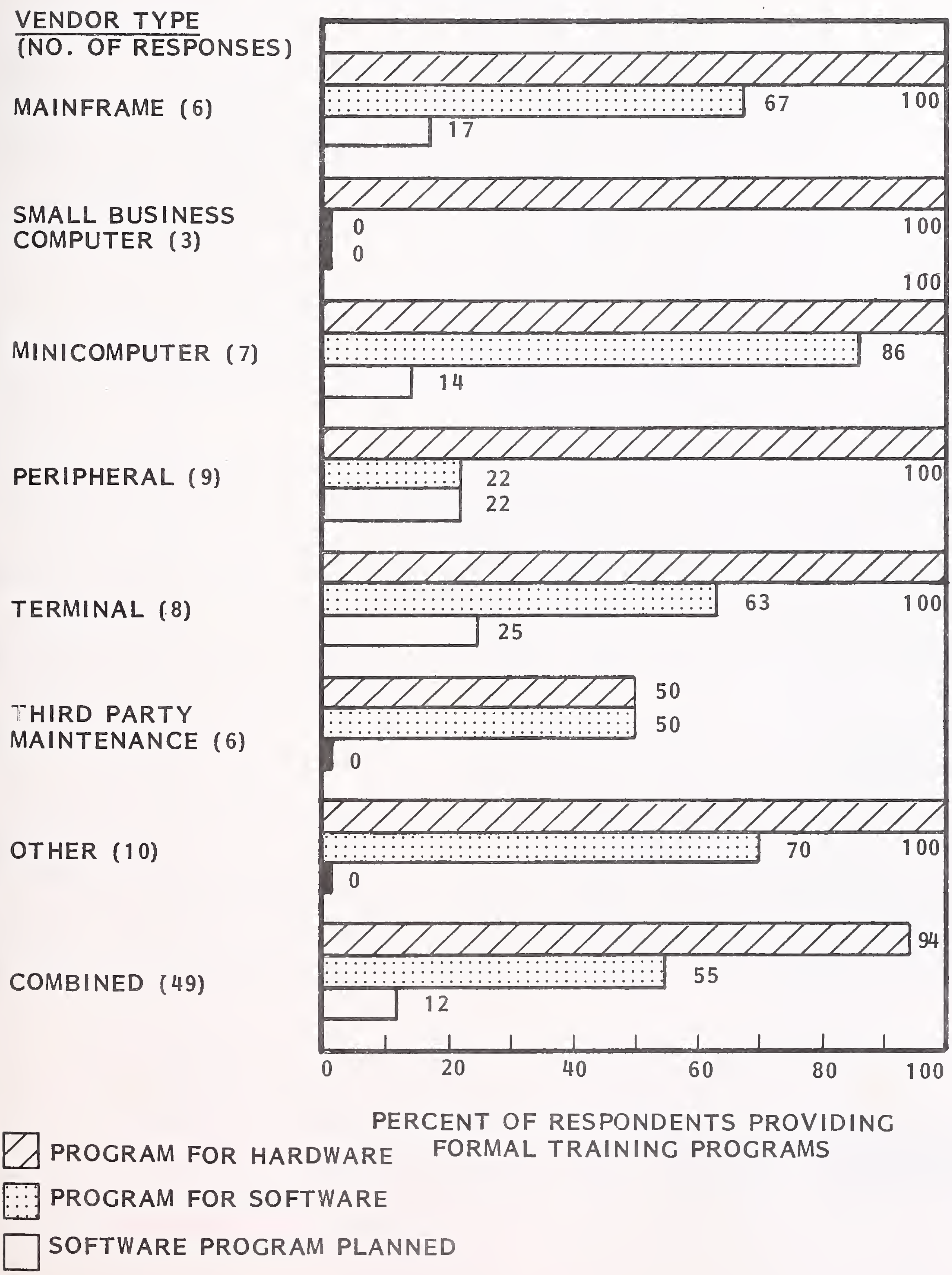


EXHIBIT V-5

FIELD ENGINEERING TRAINING LOAD FOR 1978
AND PROJECTED 1979 FOR RESPONDENT VENDORS

TYPE OF VENDOR	AVG. CLASS SIZE (STUDENTS)	AVG. COST PER STUDENT DAY ($)	STUDENT DAYS			INSTRUCTORS		
			1978		1979 % INCREASE	1978		PERCENT INCREASE
			AVG. STUDENT DAYS	NO. OF RESPONSES		AVG. NO. OF INSTRUCTORS	NO. OF RESPONSES	
MAINFRAME	10	$89.29	59,053	3	22.3%	36.5	6	34.6%
SMALL BUSINESS COMPUTER	10	123.33	1,216	3	44.7	5.3	3	16.7
MINICOMPUTER	12	104.13	1,566	7	*	3.8	6	55.0
PERIPHERAL	6	151.11	2,120	9	65.3	6.0	9	53.1
TERMINAL	6	159.00	714	8	25.0	2.9	8	41.6
THIRD PARTY MAINTENANCE	9	169.00	6,900	4	**	10.0	4	24.9
OTHER	9	65.75	1,917	7	40.1	5.7	10	27.4
ALL VENDORS COMBINED	9	$117.08	6,283	41	36.5%	9.4	46	37.5%

* 5 RESPONDENTS SAID SAME IN 1979, OR A DECREASE.
1 RESPONDENT REPORTED A 50% INCREASE IN 1979.
** 1 RESPONDENT REPORTED 100% INCREASE IN 1979.

- Average cost per student day, excluding salary and living, is $117.08 for 1978. This number will increase slightly in 1979 due to increased instructor staffing and the need for additional equipment to accomodate more students.

- The largest daily expense per student is reported by third party maintenance, resulting from relatively small classes covering a multitude of products.

• As expected, the duration of training classes varies in proportion to the complexity of the system to be maintained. Vendors interviewed report the longest classes are being conducted by third party maintenance and mainframe companies, whereas the training classes having the shortest duration are reported by "other" and terminal manufacturers (see Exhibit V-6).

• It is becoming more difficult to retrain the older and more experienced field engineers on newly designed products, especially when changing from electromechanical to electronic products. The hiring criteria and training for field engineers today is different than for applicants five years ago and will be different five years hence. Therefore, retraining of individuals who lack the proper electronic foundation is a more difficult task than training new hires with the proper credentials.

• The field engineering training departments are expending more time seeking and establishing new self-paced teaching techniques which:

  - Reduce the amount of classroom time. Vendors report reducing four week courses to three weeks with equal or better retention levels of learning.

  - Remove the peer group pressure on older field engineers who have been out of a classroom environment for a number of years.

EXHIBIT V-6

DURATION OF TRAINING CLASSES CONDUCTED BY RESPONDENT VENDORS

TYPE OF VENDOR	HARDWARE TRAINING DAYS				SOFTWARE TRAINING DAYS			
	LONGEST	SHORTEST	AVERAGE	NUMBER OF RESPONSES	LONGEST	SHORTEST	AVERAGE	NUMBER OF RESPONSES
MAINFRAME	85	15	39	7	20	4	10	5
SMALL BUSINESS COMPUTER	57	7	31	7	21	4	9	4
MINICOMPUTER	60	5	24	9	15	2	11	8
PERIPHERAL	90	3	32	13	------	---NO --	-DATA--	-------
TERMINAL	60	5	19	11	10	2	5	3
THIRD PARTY MAINTENANCE	60	10	42	4	35	3	14	3
OTHER	120	3	37	12	20	2	8	6
ALL VENDORS COMBINED	120	3	31	63	35	2	10	29

- Increase the instructor/student contact as class sizes are smaller. Vendors reported reduction in class sizes up to 25%.

• Vendors report that new hires, due to changes in college and trade school courses, have a higher level of programming knowledge than in prior years. However, they lack adequate training in troubleshooting skills.

4. TRAINING OF FIRST LEVEL MANAGEMENT

• Present growth has created a shortage of qualified first level managers.

  - Promotion of the best field engineer doesn't by default create the best manager.

  - Due to the expansion of field engineering some first level managers are not qualifed for the position.

• Respondent vendors indicated increased training efforts on improving management skills for first and second level managers.

• Respondent vendor comments on training:

  - "A number of field engineers are marginal in performance due to lack of training."

  - "Users are starting to spot the weakness in our service; it's the lack of training."

  - "Service people are not well trained in troubleshooting and take longer to repair."

  - "Our extended repair time is due to lack of troubleshooting training and experience."

- "Customers are starting to sense that mean time to repair is being extended because of training."

- Vendors comments on the personnel issue:

  - "Finding new people is a problem that won't go away."

  - "By 1980, field maintainability will be the determining factor in sales and production expansion."

  - 'Will the industry build and sell if they can't service?"

  - "Will the customer buy without service?"

  - "Field engineering must rise to a level equal to marketing to attain its mission and goals."

  - "Service cannot survive under marketing."

  - "Companies should acknowledge field engineers as quasi-salesmen, complete with incentives and bonus."

  - "Service managers have to convince corporate management that the industry has had a "free ride." Now they have to start paying."

  - "Field engineers are underpaid based upon contribution."

  - "A field engineer with 12 years experience is a pro and makes $20,000-24,000. An engineer in the lab with 5 years experience makes $30,000-35,000. The field engineer is underpaid."

5. FIELD ENGINEERING NEW HIRES AND SEPARATIONS

- Respondent vendors hired 3,946 field engineers in 1978 and experienced an attrition of 1,902, for a net retention gain of 52%. For every net increase of one person, two must be hired (see Exhibit V-7).

    - The lowest labor turnover (7.1%) was reported by the mainframe vendors, whereas the greatest (22%) was experienced by mini and small business computer manufacturers who were the smaller and faster growing members of the respondent group.

- According to those interviewed, the main reason for separations are:

    - Hired by competition for 15-20% salary increase.

    - Leaving for personal reasons (e.g., want to move to a different area, unable to work for their manager, spouse not pleased with the job requirements, etc.).

    - Leaving the industry either because of a better opportunity or job pressure.

    - Disliked the work and desire a career change.

- Vendors cite numerous reasons for this turnover rate, yet fail to examine their own operation.

    - The larger companies with proven success, such as IBM and Hewlett-Packard, have created a field engineering environment that results in a low turnover.

    - Too often field engineers change jobs over situations that are solvable by management.

EXHIBIT V-7

1978 NEW HIRES AND SEPARATIONS OF FIELD ENGINEERS AS A PERCENTAGE OF 1977 TOTAL FIELD ENGINEERS

TYPE OF VENDOR	NO. OF FIELD ENGI-NEERS 1977	NEW HIRES		SEPARATIONS	
		NO. IN 1978	% OF 1977 BASE	NO. IN 1978	% OF 1977 BASE
MAINFRAMES	12,030	1,640	13.6%	850	7.1%
SMALL BUSINESS COMPUTERS	143	168	117.5	32	22.4
MINICOMPUTERS	738	295	40.0	166	22.5
PERIPHERALS	776	293	37.8	170	21.9
TERMINALS	713	337	47.3	134	18.8
THIRD PARTY MAINTENANCE	3,316	709	21.4	365	11.0
OTHER	995	504	50.7	185	18.6
ALL VENDORS COMBINED	18,711	3,946	21.1%	1,902	10.2%

- Field engineers complain about:

  - Geographic location.

  - Lack of spare parts.

  - Overwork.

  - Too much paperwork.

  - Job pressure.

  - Job not as promised.

  - Shift work.

  - Management can't or doesn't get the job accomplished.

  - Retraining quality and frequency.

- Respondent vendors comments on attrition:

  - "We shouldn't lose people because of manager/employee conflicts, but we do."

  - "We lose people because they are new and the first line manager is green."

  - "A serviceman with three years experience could get 15% more than we pay, it takes more than money to attract people."

  - "As a manager it is my job to create an environment that will attract good people."

- "An environment for new people must be honest and not oversold."

- "Large companies such as IBM and Hewlett-Packard have a 'service culture' and seldom lose people."

- "Large companies treat people like an asset."

- "Big companies can react to solve personnel problems, which is the reason most people leave."

- "Too many people are leaving the industry for reasons that are solvable."

- "Field engineers leave when they discover the job and the company aren't as advertised."

- "Very few people leave for money only. The job was oversold to start and the company didn't live up to its promises."

- "Career paths are not well defined or explained."

- "How many field engineers end up as President?"

- "Career paths across companies are the same, and poorly defined."

- "The most tempting period for a field engineer to consider a job offer is just after his annual salary increase and he knows it will be 12 months or so before the next raise. We have gone to a six month review as opposed to an annual review."

- "We lose people in the following periods because:

  . The one to three year employee - salary doesn't keep pace with his training and expertise. This is a period of heavy training where engineers become more valuable over a relatively short time.

- The four to ten year employee - the engineer has not advanced to a point he thinks he should be. Sees a better benefit package elsewhere; company car, etc.

- The ten year and over employee - lack of opportunity for advancement; he has reached a plateau."

6. GENERAL SALARY RESPONSES

- Respondent vendors reported that trainees accounted for 10.3% of the field engineering force.

- Typical annual salaries for the maintenance force are as follows:

  - Trainees ranged from $9,400 to $12,800 with an average of $11,900.

  - Qualified field engineers averaged $15,300.

  - Senior field engineers ranged from $15,000 to $24,000 with an average of $16,800.

  - Technical support personnel ranged from $15,900 to $31,000 with an average of $24,500.

- Of the respondent vendors, terminal companies tended to pay the lowest salaries and memory manufacturers tended to pay the highest.

B. SPARE PARTS INVENTORY INVESTMENT REQUIREMENTS

- According to vendors, after manpower recruitment, the second most pressing problem facing field engineering is spare parts and logistics.

- On average, respondent vendors reported the value of spare parts being 14.3% of the value of the installed system base at manufacturing cost (Exhibit V-8). The terminal manufacturers interviewed had the highest percentage (23.2%) resulting from their extensive geographic dispersement.

- Vendors reported an average spare parts inventory valuation of 32.1% compared to 1978 average maintenance revenue. Fluctuations varied resulting from the installed base size and density, profit or loss and product line of the vendors interviewed.

- Respondent vendors generally agreed that:

  - The spare parts inventory was too large in dollar value.

  - The spare parts inventory will continue to increase in physical part count but at a slower dollar rate due to the decreasing cost of electronic components.

  - The spare board repair cycle is too long.

- The spare parts inventories of most respondent vendors are:

  - Unbalanced from a usage standpoint.

  - Composed of an excessive quantity of high cost slow moving items.

  - Overweighted with parts for older equipment.

EXHIBIT V-8

1978 AVERAGE SPARE PARTS INVESTMENT AS A PERCENTAGE OF INSTALLED BASE (AT COST) AND MAINTENANCE REVENUE BY TYPE OF VENDOR

TYPE OF VENDOR	PERCENTAGE OF INSTALLED BASE			PERCENTAGE OF MAINTENANCE REVENUE		
	HIGH	LOW	AVERAGE	HIGH	LOW	AVERAGE
MAINFRAME	20.0%	1.0%	10.6%	38.0%	10.0%	29.8%
SMALL BUSINESS COMPUTER	18.0	12.0	15.0	69.0	30.0	49.5
MINICOMPUTER	7.7	4.0	5.8	69.0	18.0	38.3
PERIPHERAL	40.0	10.0	14.8	50.0	2.0	26.5
TERMINAL	95.0	2.8	23.2	32.0	5.0	17.4
THIRD PARTY MAINTENANCE	25.0	8.6	16.8	80.0	10.0	50.8
OTHER	30.0	0.7	12.9	52.0	1.3	33.7
ALL VENDORS COMBINED	95.0%	0.7%	14.3%	80.0%	1.3%	32.1%

- Short in high turnover items for presently manufactured units.

- Hampered by elongated repair times of spare boards.

- Most vendors report problems in acquiring spares from production.

  - Production is attempting to maintain present customer shipping schedules.

  - Production requires additional personnel for assembly and testing.

  - Firms tend to ship units to revenue customers first and spares inventory second.

- The shortage of trained technical personnel to test and repair returned boards is increasing the spares pipeline.

- Boards are returned for repair that are working units (i.e., "no fault found").

  - Vendors report up to 40% of the boards returned for repair are working units.

  - The return of operable boards hampers the repair and return cycle by increasing the quantity of boards to be tested.

  - Good boards returned are generally those boards that are in short supply.

  - The return of operable boards is indicative of "shotgun diagnostic procedures." The field engineer has a problem and replaces three boards. The problem is fixed and three boards are returned for repair. However, only one board is bad, two are good.

- The creation of repair depots under field engineering has eliminated the need to compete with the production testing of new boards.

- Vendors are now acquiring board testing equipment for branch offices in an attempt to further reduce the supply pipeline.

  - Local testing and repair will also reduce the paperwork involved in returning a board with its resultant inventory debits and credits.

- Vendors approached the determination of spare parts required from a variety of directions. Some of the more popular techniques are:

  - One complete set of boards per field engineer. An additional set of spares is stocked at the branch and multiple sets at the plant.

  - Use of engineering reliability numbers to estimate early product life failure. After one year of experience, update the estimates and thereafter rely on experience statistics.

  - Computer modeling techniques to project early failure rates and modify these results with experience.

I. PRESENT AND FUTURE LEVEL OF ON-SITE REPAIR

- The respondent vendors are divided on the issue of component or board replacement (Exhibit V-9).

  - Present diagnostic programs track the failures to a board or functional unit level. Diagnostics are required over and above those presently available to pinpoint component failures.

  - Field engineers are not as proficient as rework assembly personnel in removing and replacing soldered components.

EXHIBIT V-9

ON-SITE REPAIR LEVELS FOR 1978 AND PROJECTED FOR 1982 FOR RESPONDENT VENDORS

TYPE OF VENDOR		COMPONENT LEVEL		BOARD LEVEL		UNIT LEVEL		NUMBER OF RESPONSES
		1978	1982	1978	1982	1978	1982	
MAINFRAME	NUMBER	3	3	6	6	2	2	6
	PERCENT	50.0%	50.0%	100.0%	100.0%	33.3%	33.3%	
SMALL BUSINESS COMPUTER	NUMBER	0	0	3	3	2	2	3
	PERCENT	0	0	100.0	100.0	66.6	66.6	
MINICOMPUTER	NUMBER	3	1	7	6	2	4	7
	PERCENT	42.9	14.3	100.0	85.7	28.6	57.1	
PERIPHERAL	NUMBER	5	5	9	9	1	3	10
	PERCENT	50.0	50.0	90.0	90.0	10.0	30.0	
TERMINAL	NUMBER	1	1	8	6	1	3	8
	PERCENT	12.5	12.5	100.0	75.0	12.5	37.5	
THIRD PARTY MAINTENANCE	NUMBER	4	4	5	5	3	5	6
	PERCENT	66.7	66.7	83.3	83.3	50.0	83.3	
OTHER	NUMBER	2	3	8	7	3	4	8
	PERCENT	25.0	37.5	100.0	87.5	37.5	50.0	
ALL VENDORS COMBINED	NUMBER	18	17	46	42	14	23	48
	PERCENT	37.5	35.4	95.8	87.5	29.2	47.9	

- Increasing utilization of multi-layered boards with higher population densities reduces the feasibility of a field engineer replacing a component.

- Socketed multi-legged components are the best solution for field replacement. However, sockets escalate the cost of the board.

- Components are easier to transport by the field engineers.

- Components cost less than completed tested boards.

- Components are easier to acquire than completed tested boards.

- A larger mix of components in the spare inventory would increase the parts count and the number of line items. However, more parts would be available for the same or less dollars.

- Respondent vendors perceive some change in the on-site maintenance level in 1982.

  - The popularity of unit replacement will evolve as the price of electronics continues to decline and the labor rates increase.

  - Neither board nor component swapping were projected to change by any significant percentage.

C. VENDORS' MAINTENANCE SOURCE

- Twenty-six respondent vendors reported 17.1% of their equipment was maintained by a third party. Reactions and attitudes indicated a desire to convert to direct service for end users as rapidly as budgetary and business judgement would allow (Exhibit V-10).

EXHIBIT V-10

PERFORMANCE OF EQUIPMENT MAINTENANCE FOR RESPONDENT VENDORS (OEM EXCLUDED)

(AVERAGE PERCENT OF TOTAL INSTALLED UNITS)

TYPE OF VENDOR	EQUIPMENT MAINTAINED BY									
	VENDOR		THIRD PARTY MAINTENANCE		USER		DISTRIBUTOR		DON'T KNOW	
	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.
MAINFRAME	97.0%	5	1.7%	3	3.0%	3	100.0%	1	1.0%	1
SMALL BUSINESS COMPUTER	88.0	3	22.0	1	1.0	1	6.5	2	0	0
MINICOMPUTER	76.0	8	3.9	4	26.3	5	22.5	2	0	0
PERIPHERAL	87.6	5	44.2	5	8.0	2	100.0	1	25.0	1
TERMINAL	93.2	7	2.8	5	6.1	2	10.6	2	0	0
THIRD PARTY MAINTENANCE	96.3	4	37.7	3	2.0	1	0	0	0	0
OTHER	69.6	8	10.8	5	36.9	5	5.0	1	0	0
ALL VENDORS COMBINED	84.7%	40	17.1%	26	18.7%	19	31.6%	9	13.0%	2

NUMBER OF RESPONDENTS-43

- Vendors perceive that end users prefer to receive maintenance service via the hardware vendor's field engineers and not a third party.

• While only 18.7% of the respondent vendors equipment was customer maintained, it was anticipated that this percentage would increase as it related to smaller items such as terminals.

I. THE ROLE OF THIRD PARTY MAINTENANCE

• The third party maintenance business is now ten years old. After a period of turbulent years it has established a niche in the marketplace.

• The original goals of "service for less cost" attracted few users. Those users were the federal and other government agencies plus end users with older equipment.

• The market for third party companies is:

  - Vendors who do not have a maintenance organization.

  - Vendors who have maintenance but with limited geographic coverage.

  - Vendors who desire to stabilize maintenance costs by a fixed contract price.

  - End users with integrated systems where hardware vendors are reluctant to assume the responsibility for maintenance of the entire system.

  - End users who require faster service than is available from the hardware vendor.

  - End users requiring service after the manufacturer leaves the business.

  - Used equipment dealers.

- Leasing companies.

- Factors that will accelerate third party market penetration:

  - The increasing numbers of small integrated business systems fueled by reduced hardware costs.

  - Further growth of federal and other government agencies.

  - System dispersion over a large geographic area where vendors are unable to supply service.

  - The advent of distributed data processing causing further geographic spread.

- Factors that will retard third party market penetration:

  - Utilization of remote diagnostics which allows the manufacturer to create a "fix file" on the most likely reasons for a failure and the most likely fault location. This capability enhances the vendor's mean time to repair and the vendor is acting on knowledge unavailable to the third party organization.

  - Increased utilization of self-diagnostics which will further reduce mean time to repair, and, in consort with remote diagnostics and on-site spares, will allow the user to repair the equipment, thus eliminating a service call.

  - With rapidly changing technology the end users question the capability of third party organizations to be as knowledgeable as the manufacturer.

  - End users perceive that the quality and extent of maintenance service is better from the hardware vendor than from any other source.

- As competition increases and the criteria for product selection is increasingly based on maintenance service, the hardware vendors perceive that direct control of service quality is critical.

- There is a prevalent mistrust attitude among many vendors relating to the co-mingling of spare parts and utilization of spares from one company to repair equipment owned by others.

• Most sources agree that third party maintenance firms will continue to grow and will increase their market share of the maintenance business from an estimated 5-8% to 10-13% by 1983. Due to the rapid acceleration of this market, annual estimated revenues will increase for third party maintenance from a 1978 level of approximately $300 million to $1 billion by 1983.

2. RESPONDENT VENDORS' UTILIZATION OF THIRD PARTY MAINTENANCE

• Fifty-four percent of the respondent vendors stated that a third party maintained some portion of their equipment (see Exhibit V-11).

• Most respondent OEMs, who are currently using third party for end user sales, plan to change to direct field engineers as their product density increases and are phasing out the third party service except for remote areas.

• The respondent vendors' perception of end user desires is for the hardware manufacturer to maintain the hardware.

3. VENDORS' ATTITUDES TOWARD ENTERING THIRD PARTY MAINTENANCE

• Twenty-eight percent of the respondent vendors presently maintain other brand name products (see Exhibit V-12).

- Such arrangement normally is a result of a "tie-in" sale where other products are required to complete the system.

EXHIBIT V-11

UTILIZATION OF THIRD PARTY MAINTENANCE ORGANIZATION BY RESPONDENT VENDORS

TYPE OF VENDOR	PRESENTLY USING			
	YES	PERCENT	NO	PERCENT
MAINFRAME	1	14.0%	6	86.0%
SMALL BUSINESS COMPUTER	1	33.3	2	66.7
MINICOMPUTER	5	71.4	2	28.6
PERIPHERAL	6	60.0	4	40.0
TERMINAL	5	62.5	3	37.5
THIRD PARTY MAINTENANCE	3	60.0	2	40.0
OTHER	6	60.0	4	40.0
ALL VENDORS COMBINED	27	54.0%	23	46.0%

EXHIBIT V-12

RESPONDENT VENDOR'S ATTITUDE TOWARD MAINTAINING PRODUCTS MANUFACTURED AND SOLD BY OTHERS

TYPE OF VENDOR	MAINTAIN OTHERS' EQUIPMENT							
	ALREADY DO		WOULD CONSIDER					
	NUMBER	PERCENT	YES	PERCENT	NO	PERCENT	TOTAL RESPOND.	TOTAL PERCENT
MAINFRAME	4	57.0%	0	0%	3	43.0%	7	100%
SMALL BUSINESS COMPUTER	1	33.3	0	0	2	66.7	3	100
MINICOMPUTER	1	14.3	2	28.6	4	57.1	7	100
PERIPHERAL	1	10.0	4	40.0	5	50.0	10	100
TERMINAL	4	50.0	1	13.0	3	37.0	8	100
THIRD PARTY MAINTENANCE	3	60.0	2	40.0	0	0	5	100
OTHER	0	0	5	50.0	5	50.0	10	100
ALL VENDORS COMBINED	14	28.0%	14	28.0%	22	44.0%	50	100%

- An additional 28% of the respondent vendors expressed a willingness to maintain other products. However, the responses were hedged with --"depends on the product...," "depends on the area...," "depends on the customer...." The response attitude reflects an underlying resistance to perform this service.

  - Firms most likely to enter third party are computer services firms that offer on-site hardware and are building a field engineering force that will be under-utilized and hence a revenue drain until the installed base is increased.

  - Established hardware vendors with an adequate installed base are short on personnel and are not likely to be seeking an additional workload by assuming maintenance of equipment manufactured by others.

D. PRICING AND PACKAGING OF MAINTENANCE SERVICES

- Respondent vendors' prices for an annual maintenance contract ranged from 5% to 27.3% of the purchase price of the system (see Exhibit V-13). The highest average reported by peripheral (12.9%) and lowest being mainframe (6.8%) vendors.

- Respondent vendors computed the price of the annual maintenance contracts by considering:

  - Manufacturing cost of spares.

  - Quantity of spares required.

  - Inventory stocking cost of spares.

  - Storage and distribution costs of spares.

EXHIBIT V-13

1978 AVERAGE PERCENTAGE FOR ANNUAL MAINTENANCE CHARGES AS A PERCENT OF EQUIPMENT PURCHASE PRICE FOR RESPONDENT VENDORS

TYPE OF EQUIPMENT	HIGH %	LOW %	AVERAGE %	NUMBER OF RESPONDENTS
MAINFRAME	10.0%	5.3%	6.8%	4
SMALL BUSINESS COMPUTERS	18.5	8.0	11.9	5
MINICOMPUTER	14.4	6.0	9.7	9
PERIPHERAL	27.3	5.0	12.9	11
TERMINAL	15.0	6.5	9.7	11
OTHER	15.0	5.0	10.2	5
ALL VENDORS COMBINED	27.3%	5.0%	10.5%	45

- Cost of spare repair.
- Mean time between failures.
- Mean time to repair.
- Field engineer skill level required to repair.
- Cost of training.
- Cost of additional tools and test equipment.
- Sales to date and projected marketing forecasted.
- Projected or actual geographic distribution of installations.
- Prices charged by competition.
- Profit or return on investment.
- Profit as a percentage of revenue.

• Few respondent vendors ignored competitive pricing and considered only cost plus a reasonable return on investment when establishing maintenance contract prices. Maintenance rates of those vendors who established maintenance rates without considering competition, reported an annual maintenance ratio of 12% to 16% of the equipment purchase price, which is higher than the respondent vendors' combined average of 10.5%.

• Some respondent vendors reported considering the implementation of zone charges.

I. BILLING RATES FOR TIME AND MATERIAL

- Exhibit V-14 reflects the respondent vendors' present 1978 chargeable labor rates for time and material calls with $46 per hour (prime shift) as the average labor rate.

- Ninety-three percent of the vendors interviewed had recently announced increases for time and material calls or were planning to change the rates within the next 60 days.

- Due to utilization by the users, the vendors interviewed were less reluctant to increase rates for time and material than for maintenance contracts.

- The chargeable rates for time and material calls will increase 18-25% in 1979. The chargeable rates for maintenance contracts will increase 8-15% in the same period.

- Most vendors perceive that time and material has the potential to be more profitable than maintenance contracts; however, they prefer maintenance contracts because:

  - It is easier to schedule the engineering workload.

  - Vendors can utilize field engineering spare time by performing preventive maintenance.

  - It creates a planned revenue stream.

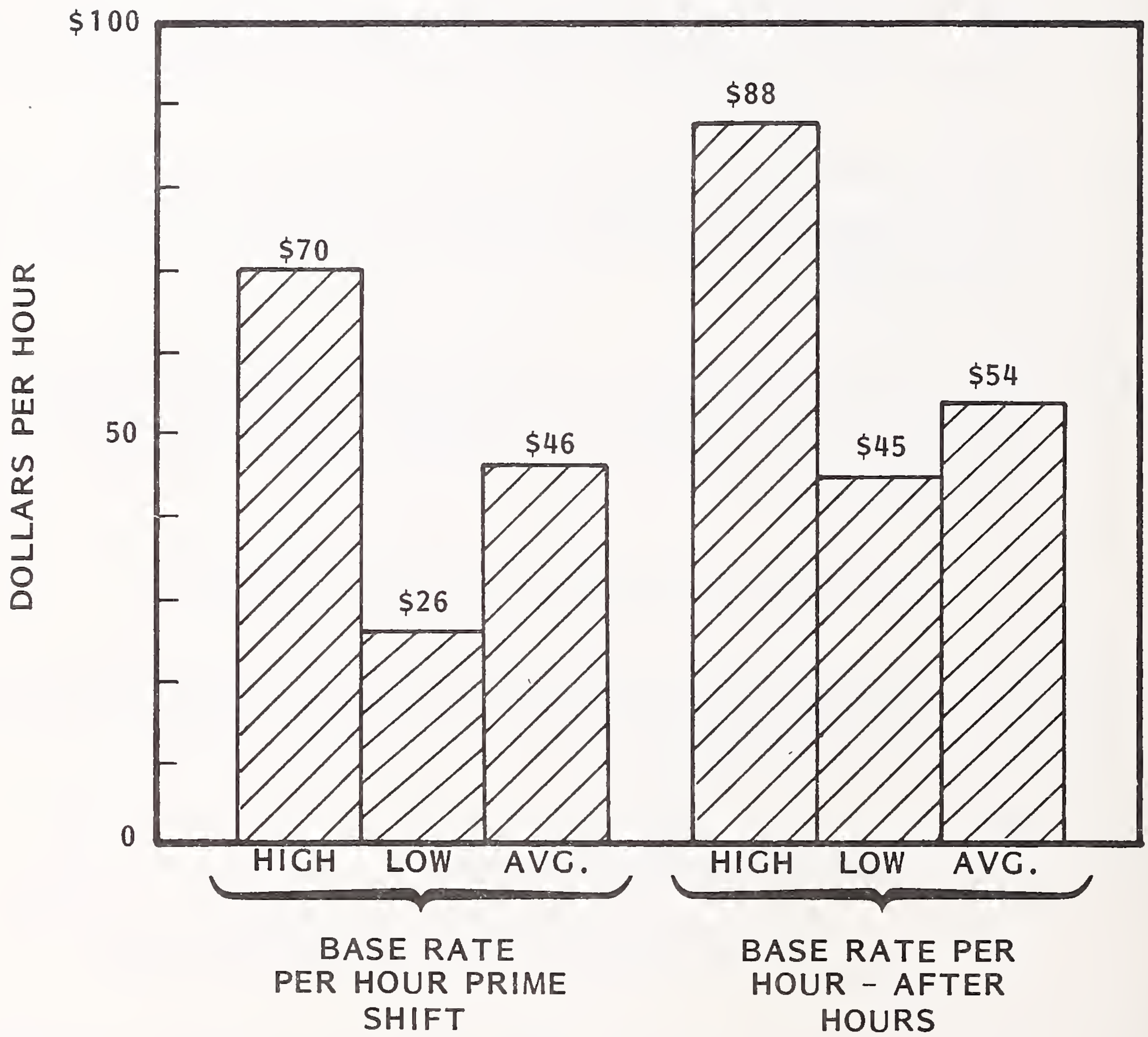
  - It eases the fiscal revenue and expense planning tasks.

- Some reasons for vendors preferring time and material pricing instead of maintenance contracts include:

  - A potential to be more profitable.

EXHIBIT V-14

CHARGES FOR TIME AND MATERIAL SERVICE CALLS BY RESPONDENT VENDORS



- The reduction free "no fault found" maintenance calls to zero.

- Reducing the number of field engineers required.

- The workload per field engineer can be increased.

- Performing preventive maintenance is a separate chargeable service.

2. EXTENDED SHIFT BILLING RATES FOR ANNUAL MAINTENANCE CONTRACTS

- The percentage of rate increase for extended maintenance coverage is oriented towards penalties for weekend and third shift, reflecting the difficulties in scheduling and staffing for non-prime shift service (see Exhibit V-15).

- Increasing user product utilization and hence the need for non-prime shift maintenance coverage will continue to expand. Sixty-five percent of the respondent users require maintenance support for other than prime shift. This will increase to 95% by 1983.

- Expanded use of data communications will accelerate the utilization of equipment at night and on weekends when telephone rates are cheaper.

3. 1978 AND 1983 ANALYSIS OF MAINTENANCE COST

- Respondent vendors anticipated the proportion of direct field engineering per cost dollar expended would increase to 51% for 1983 versus 49% in 1978 (Exhibit V-16).

    - This increase was offset by a decrease in material and "other" expenditures.

4. COST FOR AVERAGE SERVICE CALL

- Labor represents 44% of the cost to respond to service calls (Exhibit V-17).

EXHIBIT V-15

RATIO OF CHARGES FOR EXTENDED MAINTENANCE COVERAGE BY RESPONDENT VENDORS

MAINTENANCE COVERAGE	HIGH	LOW	AVERAGE	NUMBER OF RESPONSES
2 SHIFTS/5 DAYS	200%	110%	134.4%	18
3 SHIFTS/5 DAYS	300	112	166.9	16
2 SHIFTS/6 DAYS	285	115	167.0	10
3 SHIFTS/6 DAYS	380	119	203.6	9
3 SHIFTS/7 DAYS	285	127	175.7	11

ONE SHIFT X 5 DAYS = 100% OF THE MAINTENANCE CONTRACT RATE

EXHIBIT V-16

RESPONDENT VENDORS' MAINTENANCE COST BUILD-UP FOR 1978 AND PROJECTED FOR 1983

COST FACTOR	1978 ACTUAL			1983 PROJECTED		
	HIGH	LOW	AVERAGE	HIGH	LOW	AVERAGE
FIELD ENGINEER	75%	27%	48.90%	80%	25%	50.69%
TRAVEL EXPENSES	35	1	10.59	45	1	10.72
OTHER DIRECT EXPENSES	39	3	13.30	39	2	14.02
MATERIALS	50	5	16.71	33.3	5	16.38
BURDEN	42	3	15.44	40	3	16.08
OTHER	26	2	13.29	26	5	11.25

EXHIBIT V-17

AVERAGE MAINTENANCE SERVICE CALL COST BUILDUP AS REPORTED BY RESPONDENTS

VENDOR TYPE	COST BUILDUP				
	LABOR	TRAVEL	PARTS AND MATERIAL	OTHER	TOTAL
MAINFRAME MANUFACTURER	$76.20	$25.20	$61.00	$54.00	$216.40
SMALL BUSINESS COMPUTER	71.50	10.50	11.00	47.00	140.00
MINICOMPUTER	57.20	52.00	18.60	18.50	146.30
PERIPHERAL	69.20	27.00	39.40	34.00	169.60
TERMINAL	39.43	17.83	32.11	18.17	107.54
THIRD PARTY MAINTENANCE	53.00	7.00	10.50	8.50	79.00
OTHER	67.25	13.70	31.50	17.33	129.78
AVERAGE ALL VENDORS COMBINED	$ 61.97	$ 21.89	$ 29.16	$ 28.21	$141.23

- Travel was deemed to be 15% of the total cost of a service call including labor cost.

  - Travel costs varied widely among the vendors and did not relate to anticipated patterns, such as higher for terminal vendors and lower for mainframes.

- Typical direct burdened labor cost was reported as $15 per hour for the average of all companies.

- Respondent vendors reported an average of one hour of labor is expended for travel per service call.

- The "other" category contains other direct and burden expenses, such as dispatch, local inventory functions, etc.

- Vendors' desire to reduce the number of service calls because:

  - The high percentage of users that are on maintenance contracts. Revenue is received regardless of the number of service calls.

  - The shortage of personnel is relieved for each call that can be avoided.

5. REVENUE ANALYSIS

- Respondent vendors reported a total of $1,199,350,000 of maintenance revenue for 1978. Mainframe vendors accounted for $782,000,000, or 65% of the total (see Exhibits V-18 and V-19).

- Exhibit V-20 shows that the average maintenance revenue for all vendors combined was $29,300,000, with large mainframe respondents accounting for 65% of the total.

EXHIBIT V-18

FORECAST OF TOTAL MAINTENANCE REVENUES
AND AVERAGE MAINTENANCE REVENUES
FOR RESPONDENT VENDORS

TYPE OF VENDOR (NO. OF RESPONSES)	TOTAL MAINTENANCE REVENUE ($M)				AVERAGE MAINTENANCE REVENUE ($M)		
	1978	1980	1983	1978-1983 AAGR	1978	1980	1983
MAINFRAMES (5)	$ 782.0	$ 930.0	$1,263.9	10.1%	$156.4	$186.0	$252.8
SMALL BUSINESS COMPUTERS (3)	13.5	23.0	66.4	37.5	4.5	7.7	22.1
MINICOMPUTERS (5)	33.6	51.6	83.9	20.1	6.7	10.3	16.8
PERIPHERALS (8)	58.1	91.6	178.6	25.2	7.3	11.5	22.3
TERMINALS (6)	53.5	80.4	161.2	24.7	8.9	13.4	26.9
THIRD PARTY MAINTENANCE (5)	184.0	244.5	418.0	17.8	36.8	48.9	83.6
OTHER (9)	74.7	140.6	299.5	32.0	8.3	15.6	33.3
ALL VENDORS COMBINED (41)	$1,199.4	$1,561.7	$2,471.5	15.3%	$ 29.3	$ 38.1	$ 60.3

EXHIBIT V-19

1978 MAINTENANCE REVENUE FOR RESPONDENT VENDORS BY TYPE OF VENDOR

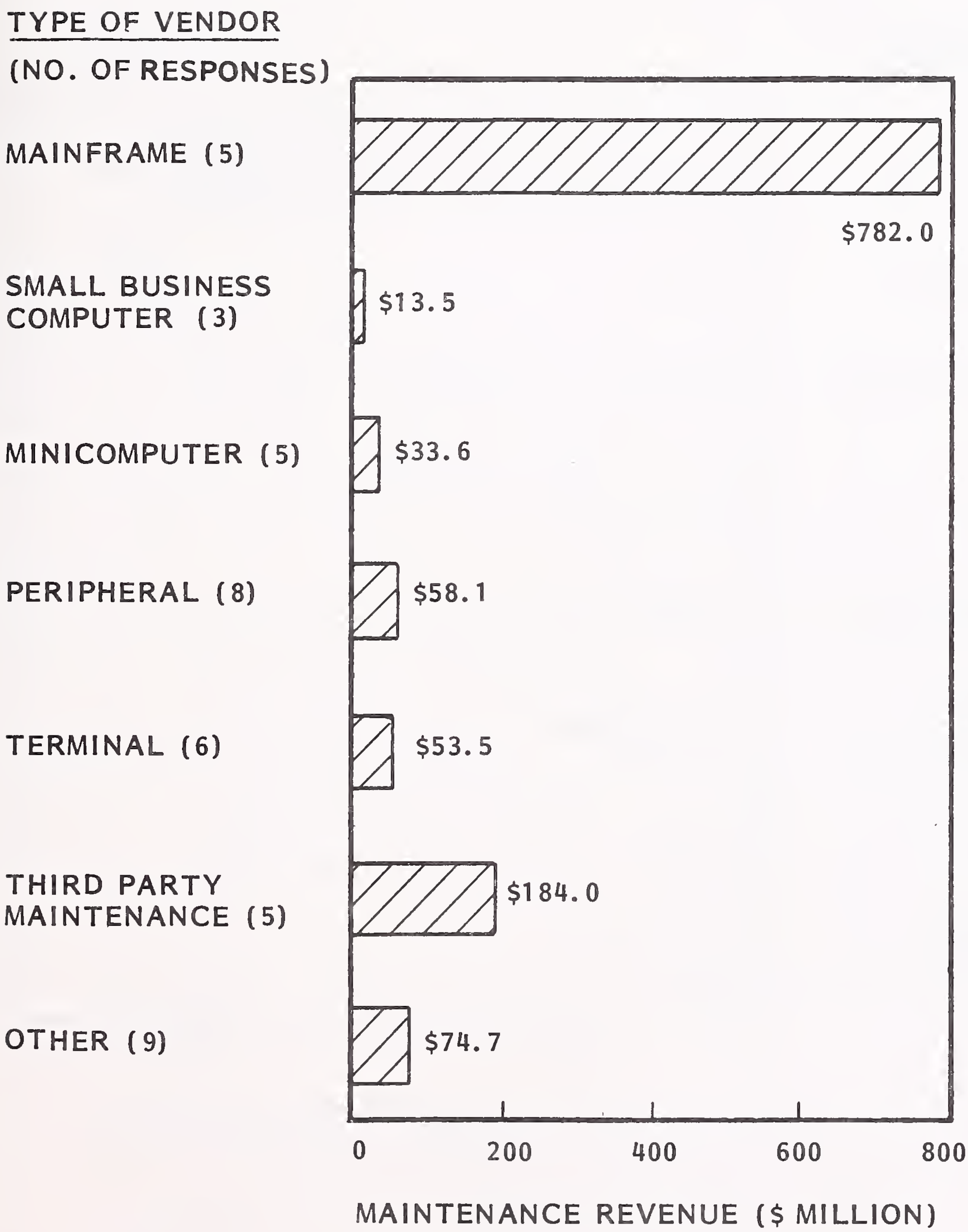
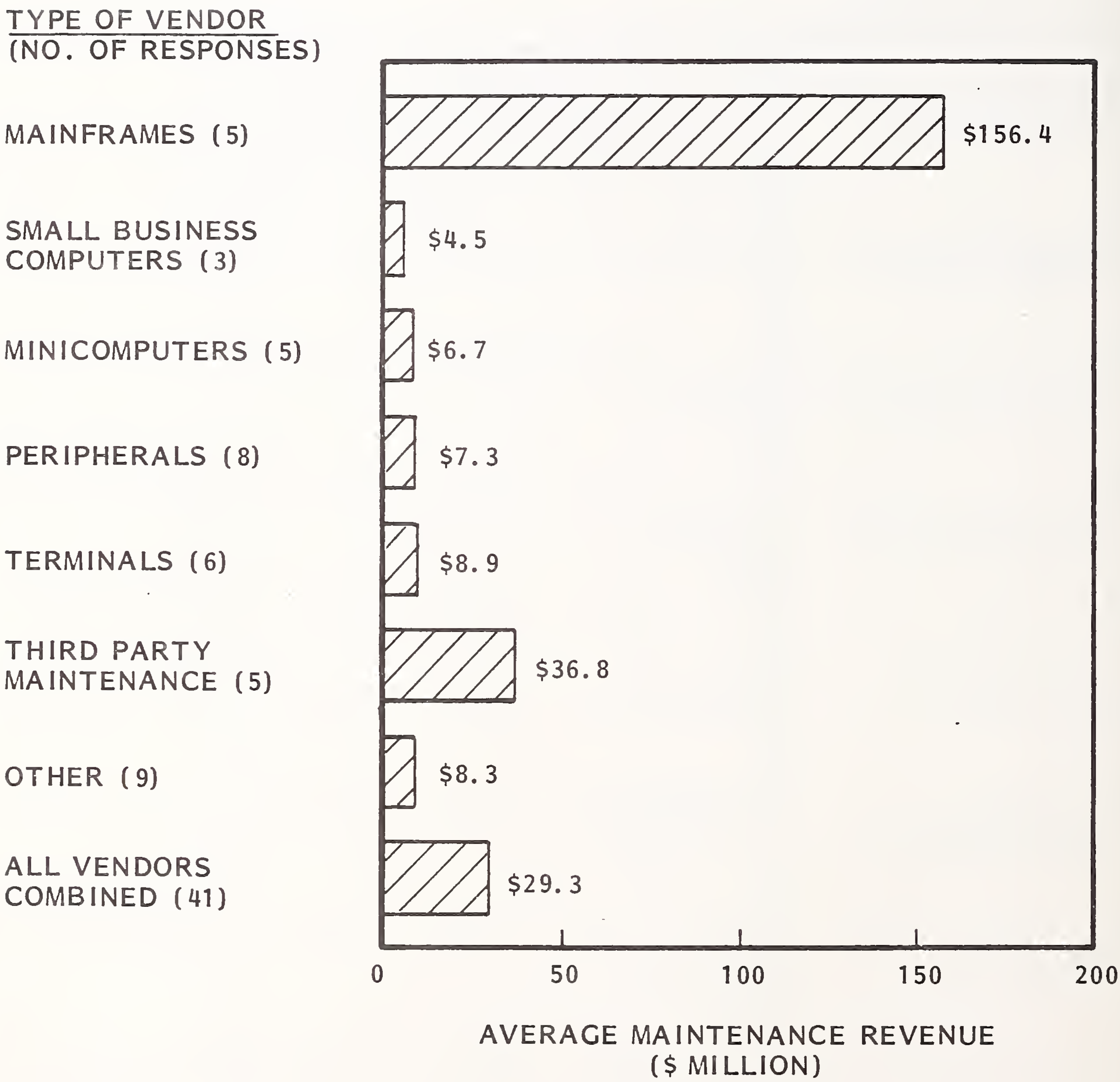


EXHIBIT V-20

AVERAGE 1978 MAINTENANCE REVENUE FOR RESPONDENT VENDORS



- Respondent vendors projected a revenue increase of 15.3% AAGR for 1978 through 1983 with small business computers as a group increasing 37.5% over the same time frame. Average maintenance revenue of those interviewed was projected to increase from $29,300,000 in 1978 to $60,300,000 by 1983, and AAGR of 15%.

- Maintenance revenue per field engineer for the respondent vendors averaged $57,400 in 1978 and was projected to be $58,100 in 1983 (see Exhibits V-21 and V-22).

- The growth of revenue per field engineer for the respondent vendors is projected to range from 1.5% to 3.6% for the period of 1978 to 1983 (AAGR of 0.5%).

  - The small change in revenue per employee reflects the vendor's belief that little if anything can be done to improve productivity.

  - Vendors projected the revenue per field engineer in current dollars.

  - As stated in the Executive Summary, INPUT disagrees with the vendors and projects that productivity for the installed base must improve and the revenue per field engineer must increase to meet the revenue maintenance demands. This increase will be derived through non-traditional means; e.g., remote diagnostics, and must occur since field engineering will be unable to achieve their hiring goals required to maintain the equipment in the traditional manner.

- All vendors combined reported a total maintenance cost budget of $979,200,000 for 1978 (see Exhibit V-23).

  - This equates to an average of $23,900,000 per vendor (see Exhibit V-24). Average cost is 81.7% of maintenance revenues leaving an average gross pre-tax profit of 18.3% per vendor.

EXHIBIT V-21

REVENUE AND 1978 AVERAGE MAINTENANCE COST
PER FIELD ENGINEER FOR RESPONDENT VENDORS

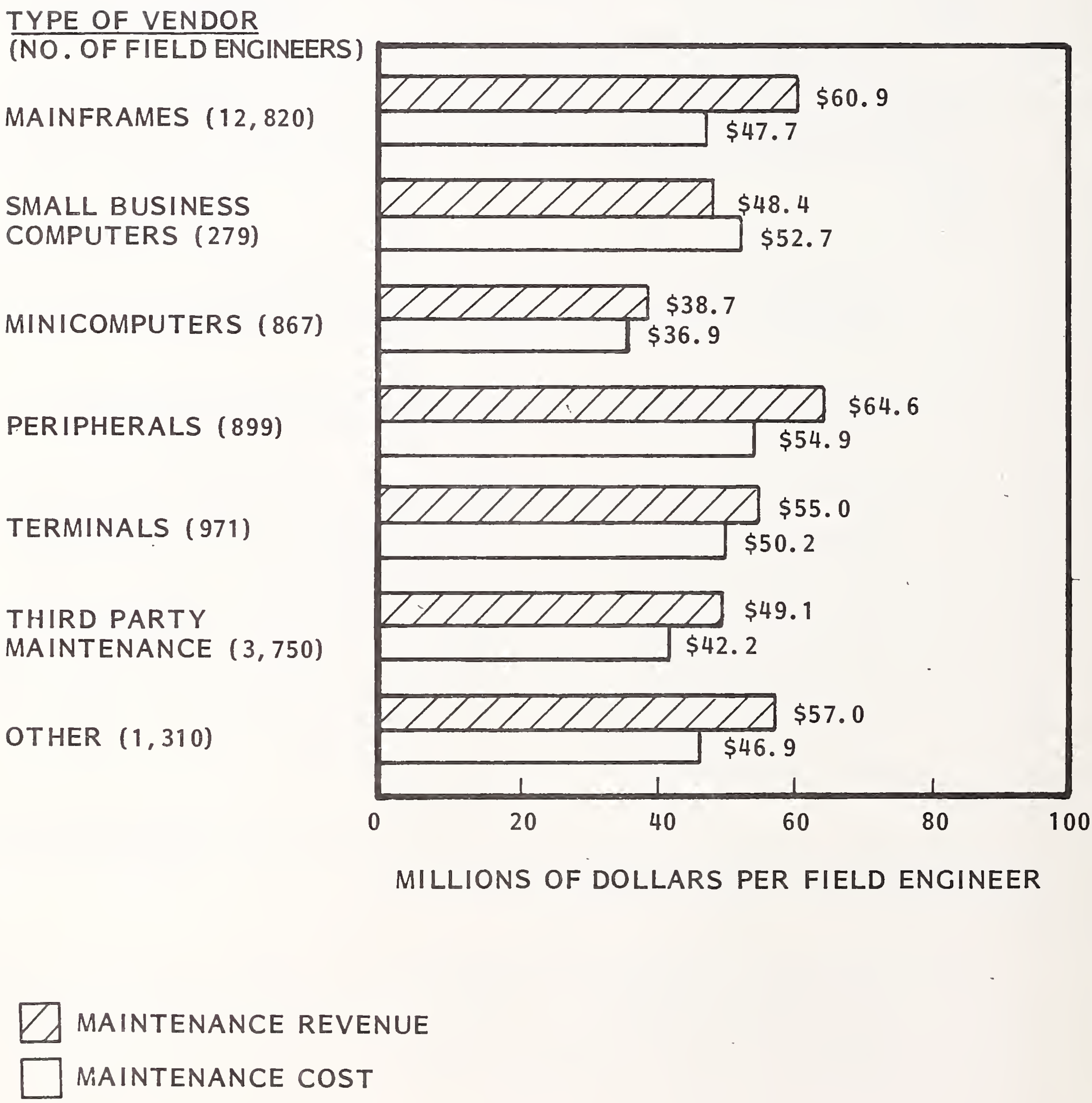


EXHIBIT V-22

RESPONDENT VENDORS' FORECAST OF AVERAGE MAINTENANCE REVENUE PER FIELD ENGINEER

TYPE OF VENDOR (NUMBER OF FIELD ENGINEERS)	AVERAGE MAINTENANCE REVENUE PER FIELD ENGINEER ($ THOUSAND)			
	1978	1980	1983	1978-1983 AAGR
MAINFRAME (12,820)	$ 60.9	$ 62.4	$ 64.7	1.2%
SMALL BUSINESS COMPUTER (279)	48.4	45.5	56.9	3.2
MINICOMPUTER (867)	38.7	42.9	46.4	3.6
PERIPHERAL (899)	64.6	67.3	70.0	1.7
TERMINAL (971)	55.0	48.9	50.7	(1.5)
THIRD PARTY MAINTENANCE (3,750)	49.1	48.8	48.0	(0.1)
OTHER (1,310)	57.0	60.5	60.4	1.2
ALL VENDORS COMBINED (20,896)	$ 57.4	$ 57.8	$ 58.1	0.5%

EXHIBIT V-23

1978 TOTAL MAINTENANCE COST BUDGET
FOR RESPONDENT VENDORS

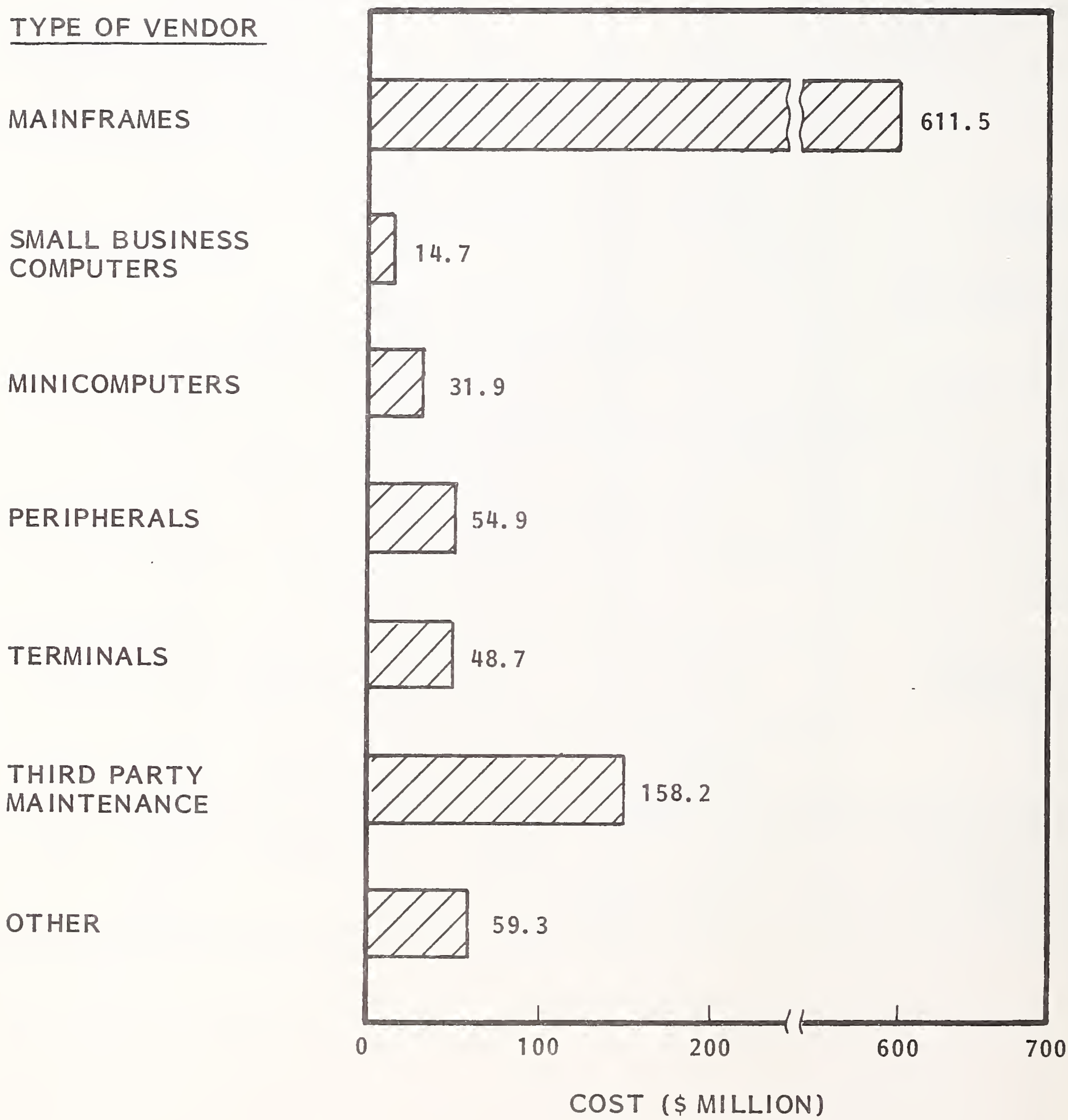
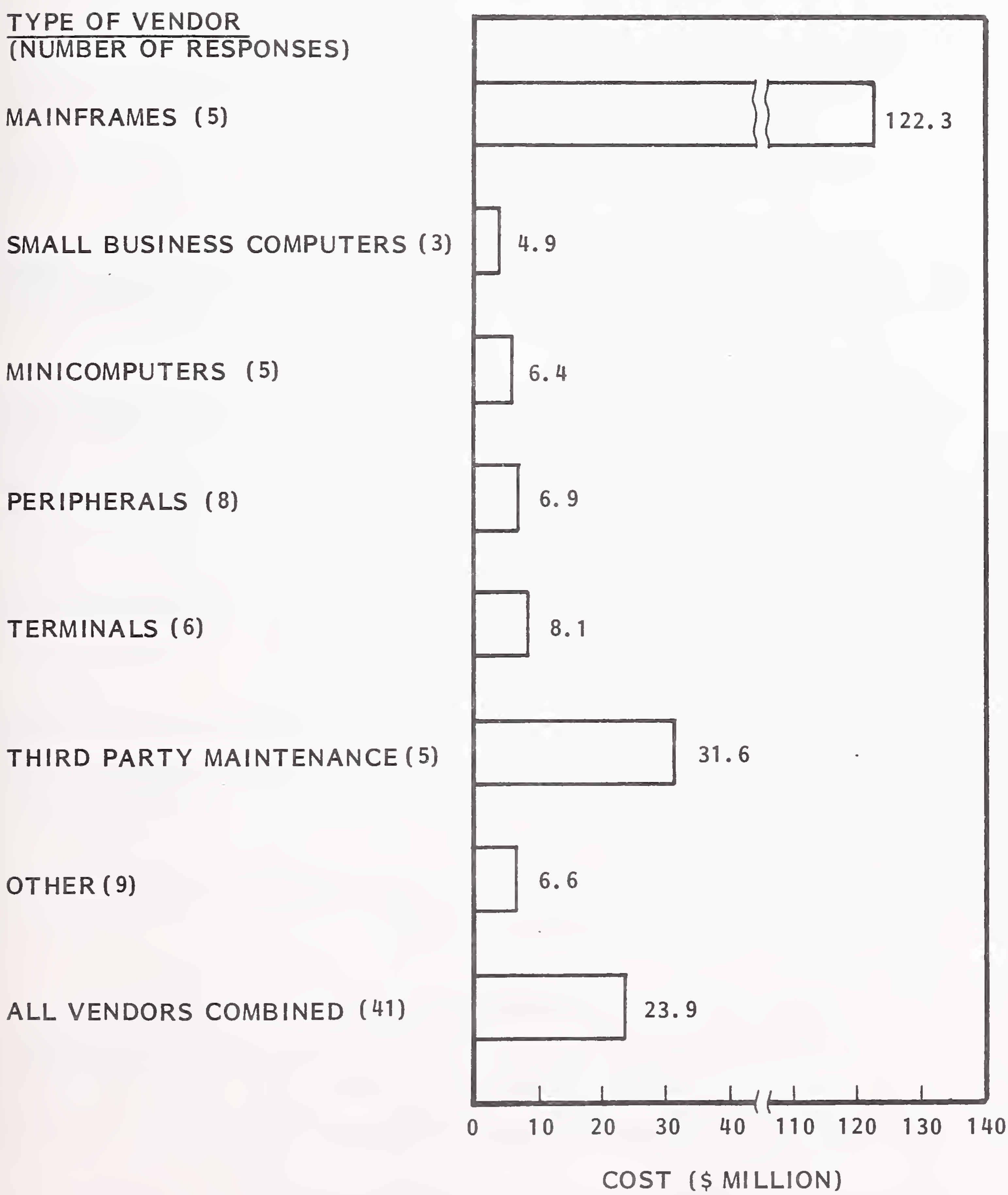


EXHIBIT V-24

1978 AVERAGE MAINTENANCE COST BUDGET FOR RESPONDENT VENDORS



- Costs, as a percentage of maintenance revenue, were highest for small business computer companies (108.8%) and lowest for mainframe companies (78.2%) (see Exhibit V-25). These results reflect the complexity of systems service problems in relation to the maintenance revenue per system.

- Average cost per field engineer for 1978 was reported as $46,860.

6. VENDORS' 1978 PRE-TAX PROFIT OR (LOSS)

- Ninety-four percent of the respondent vendors reported a pre-tax profit on maintenance service ranging from 7.6% to 21.7% of maintenance revenues (see Exhibit V-26).

- Vendors with clustered equipment (i.e., multiple devices in one installation) or high value installations such as mainframes and certain vendors of the "other" category tend to maximize profit and field engineering time by minimizing travel.

- Vendors with geographically dispersed (and typically low value) installations tend to achieve smaller profit margins.

- Vendors with geographically dispersed, low value installations, compounded by software such as minicomputers and small business systems average a lower profit return on revenue.

- The continuing increase of labor expense will exert heavy pressure on profit margins in the 1979 through 1981 time frame.

  - During this period, firms that have recently converted to profit centers from cost centers will show a better than average performance in profit than firms presently structured on a profit basis. This improvement is due to the initial surge created when major cost items are identified and controlled.

EXHIBIT V-25

1978 COST BUDGET AS A PERCENT OF
MAINTENANCE REVENUE FOR RESPONDENT VENDORS

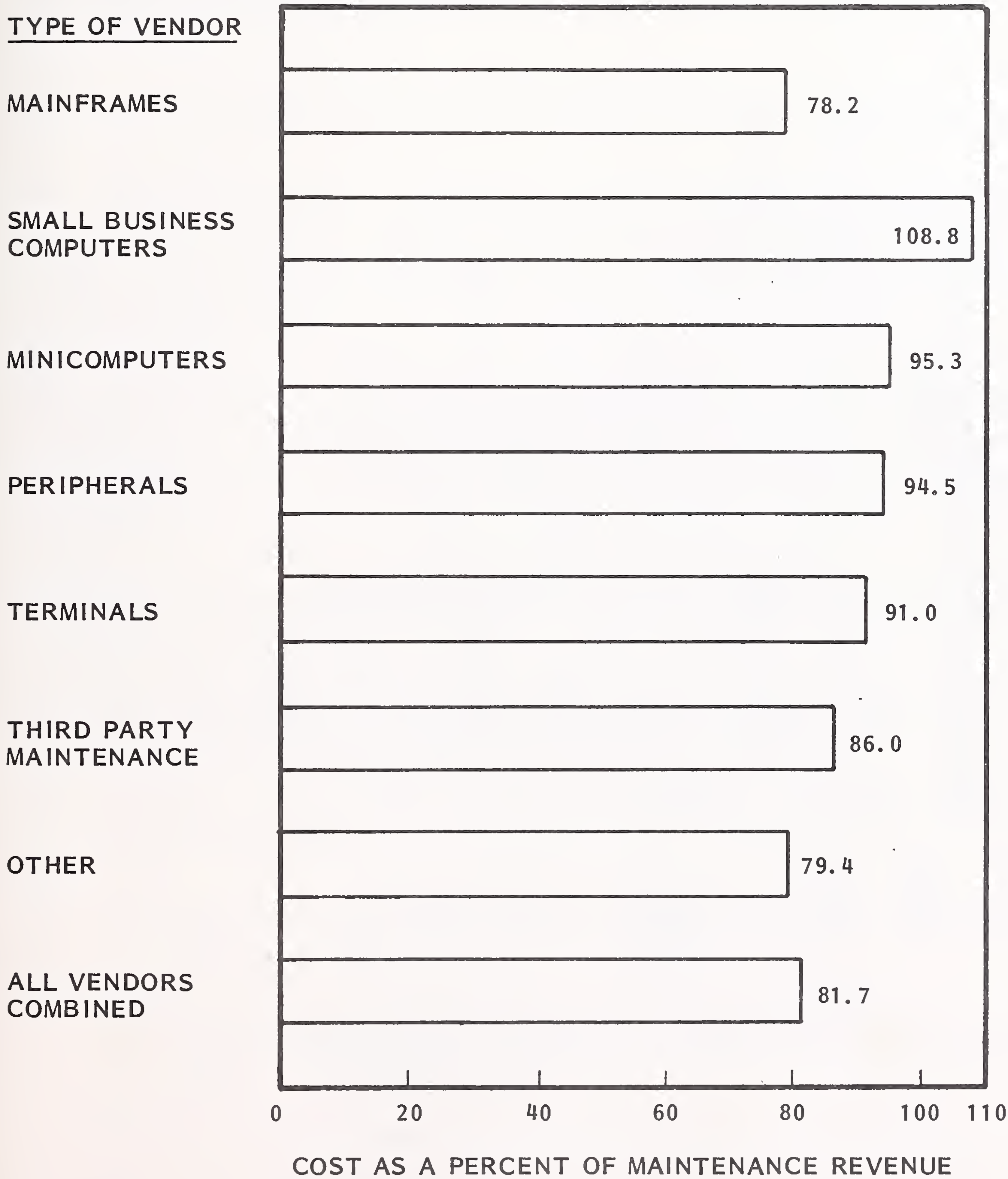
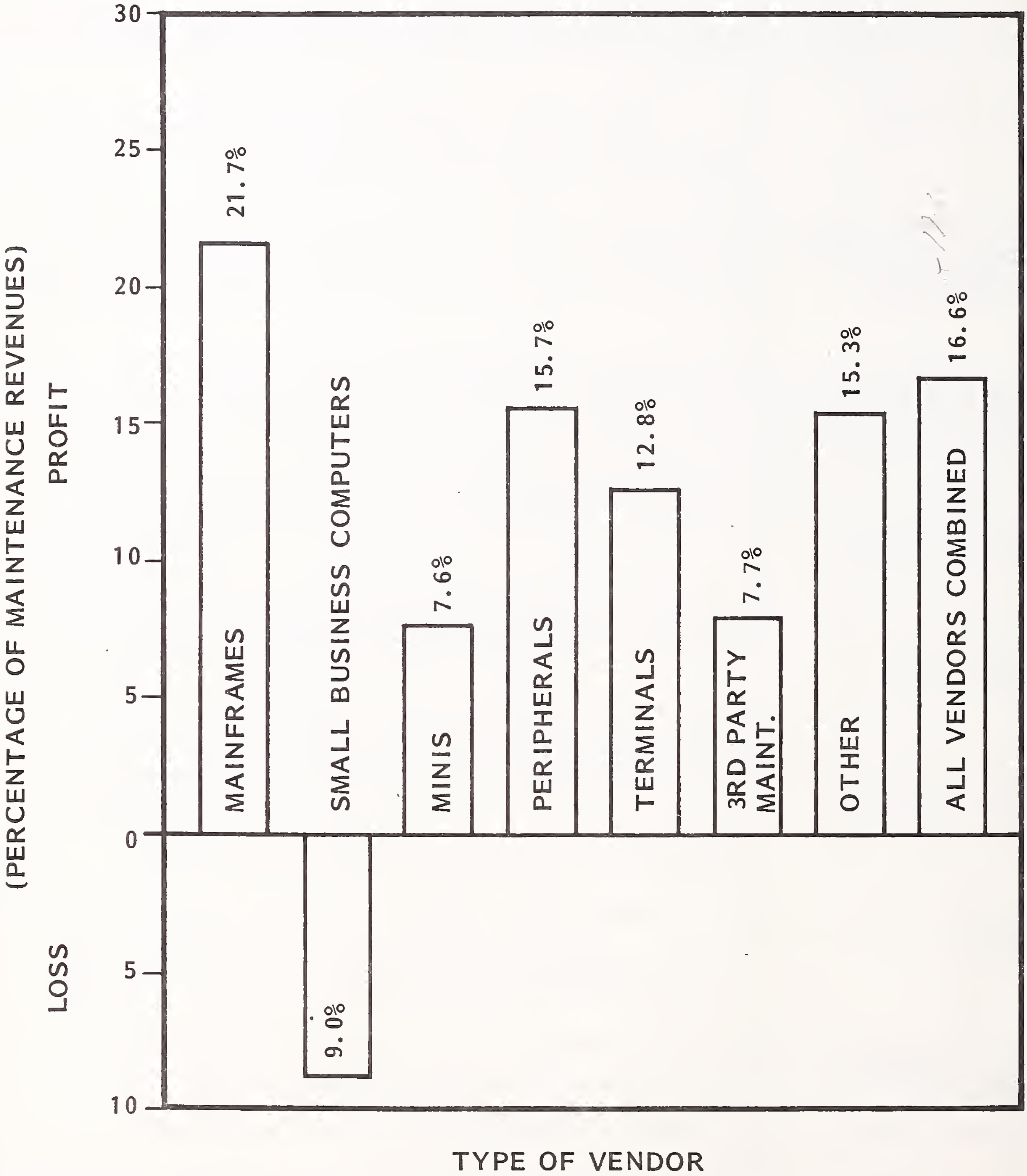


EXHIBIT V-26

RESPONDENT VENDORS' PERCENTAGE OF 1978 PRE-TAX PROFIT/LOSS AS A PERCENT OF MAINTENANCE REVENUES



7. METHODS FOR SELLING MAINTENANCE AND SUPPLIES

- For 25 (61%) respondent vendors the sale of maintenance contracts to users was the responsibility of the marketing department (Exhibit V-27).

- Only in four (10%) companies was a maintenance contract sale the responsibility of field engineering.

- In 16 companies (39%) a commission is paid to the salesman or field engineer.

- Typically no commission is paid, but there are some incentives for the field engineer such as a savings bond; the individual with the most sales per district or region receives a vacation trip, or it is a factor in some field engineering award program.

- In the majority of the companies, the field engineering manager is responsible for the sale of renewal of maintenance contracts. The branch is given credit for this sale and it becomes a budget factor and/or contribution to the bonus program.

- In 35 companies (85%) the sale of supplies and accessories is the responsibility of marketing.

- Field engineering has this responsibility in only six companies (15%).

- Respondent companies that pay the field engineer a commission cite the following advantages:

    - Sales of supplies and accessories increased 9-17% when the program was implemented.

    - Field engineers call on accounts for service that marketing doesn't cover.

EXHIBIT V-27

EXTENT OF DIRECT SALES ACTIVITY BY FIELD ENGINEERS
IN RESPONDENT MAINTENANCE ORGANIZATIONS

TYPE OF VENDOR (NUMBER OF RESPONDENTS)	MAINTENANCE CONTRACTS SOLD BY					F.E. ACCESSORIES OR SUPPLY SALES	
	SALESMAN	FIELD ENG	BOTH	SALESMAN*	FIELD ENG*	NO. OF 'YES'	NO. OF 'NO'
MAINFRAME (5)	1	0	4	1	2	1	4
SMALL BUSINESS COMPUTER (2)	1	0	1	0	0	0	2
MINICOMPUTER (6)	3	2	1	2	2	1	5
PERIPHERAL (8)	6	1	0	2	0	0	8
TERMINAL (7)	6	1	0	2	0	1	6
THIRD PARTY MAINTENANCE (4)	3	0	1	3	0	1	3
OTHER (9)	5	0	3	2	0	2	7
ALL VENDORS COMBINED (41)	25	4	10	12	4	6	35

* = COMMISSION PAID - 4 OUT OF 41 RESPONDENTS WERE PLANNING TO ADD COMMISSION POLICIES FOR THE SALE OF MAINTENANCE CONTRACTS

- The field engineers effort is reflected in his paycheck; hence, the effort is measured and rewarded.

- Disadvantages:

  - Not all field engineers enjoy selling.

  - Selling detracts from the job they were hired to perform.

  - Selling takes time that is non-productive.

- The sales and marketing of maintenance services, except by third party maintenance companies, is not up to the standard one expects from the information processing industry.

  - Vendors appear to lack a clear direction as to responsibility for sales of maintenance service and its implementation.

  - Studies completed by INPUT conclude that incentives produce sales in the information processing industry, yet only 39% of the respondent vendors pay commission for the sale of maintenance services.

- The sales of supplies and accessories can be an additional source for high profit revenue. Yet only 15% of the respondent vendors were utilizing the field maintenance force to sell these products.

- Vendors should examine their present marketing channels to determine if the resources available to sell maintenance services, supplies and accessories are being properly utilized and compensated to achieve the maximum revenue potential.

E. ANALYSIS OF UTILIZATION OF MAINTENANCE MANPOWER

1. ANALYSIS OF MONTHLY TROUBLE CALLS

- Exhibits V-28 and V-29 analyze the total and average service calls by vendor type and represent a total of 5,396,220 service calls per year.

  - The average field engineer handles 26.1 calls per month from a high reported by third parties (53 calls per month) to a low for peripheral vendors (9.8 calls per month).

  - Repeat calls accounted for 10.1% of the total trouble calls (equal to 20,882 respondent field engineering man days per year).

  - "No fault found" calls were also 10.1% of the total trouble calls (equal to 20,882 respondent field engineering man days per year).

- Third party maintenenace companies rank highest in utilization and efficiency with 53 calls per month per field engineer, a repeat call rate of only 6.9% and a "no fault found" rate of 7.9%.

  - The statistical data related to the monthly trouble calls suggest that third party maintenance firms are more efficient in manpower utilization than hardware manufacturers.

  - Fifty-two percent of the respondent users ranked the overall maintenance performance of third party companies as low. Therefore, while the utilization of manpower is high, the quality of the service as viewed by the sample of respondent users was rated low.

EXHIBIT V-28

TOTAL TROUBLE CALL WORKLOAD
FOR RESPONDENT VENDORS

TYPE OF VENDOR (NO. OF RESPONSES)	TOTAL ANNUAL CALLS	TOTAL MONTHLY CALLS	TOTAL REPEAT CALLS	TOTAL CALLS WITH NO FAULT FOUND
MAINFRAMES (4)	2,100,240	175,020	23,124	17,586
SMALL BUSINESS COMPUTERS (3)	63,000	5,250	535	772
MINICOMPUTERS (5)	120,348	10,029	1,115	2,437
PERIPHERALS (8)	102,888	8,574	1,123	775
TERMINALS (6)	444,576	37,048	2,889	5,446
THIRD PARTY MAINTENANCE (5)	2,384,400	198,700	13,710	15,785
OTHER (6)	180,768	15,064	2,744	2,727
ALL VENDORS COMBINED (37)	5,396,220	449,685	45,240	45,528

EXHIBIT V-29
TYPICAL MONTHLY TROUBLE CALL WORKLOAD BY FIELD ENGINEER
(AVERAGE RESPONSE)

TYPE OF VENDOR	AVERAGE ANNUAL CALLS	AVERAGE MONTH	AVERAGE PER F.E.	AVERAGE REPEAT CALLS		AVERAGE NO FAULT FOUND		NUMBER OF RE-SPONSES
			MONTH	AVERAGE MONTH	PERCENT	AVERAGE MONTH	PERCENT	
MAINFRAME	525,060	43,755	17.3	5,781	13.2%	4,397	10.0%	4
SMALL BUSINESS COMPUTER	21,000	1,750	18.8	178	10.2	258	14.7	3
MINICOMPUTER	24,070	2,006	18.7	223	11.1	487	24.3	5
PERIPHERAL	12,861	1,072	9.8	140	13.1	97	9.0	8
TERMINAL	74,096	6,175	38.4	482	7.8	908	14.7	6
THIRD PARTY MAINTENANCE	476,880	39,740	53.0	2,742	6.9	3,157	7.9	5
OTHER	30,128	2,511	21.9	457	18.2	455	18.1	6
ALL VENDORS COMBINED	145,844	12,154	26.1	1,227	10.1%	1,231	10.1%	37

2. ENGINEERING CHANGE NOTICE (ECN) AS A FACTOR

- The man days required for the installation of ECNs (engineering change notices or orders) averaged 5.9% for vendors interviewed (Exhibit V-30).

  - This 5.9% applied to the respondent vendors' total work force and equalled 61,600 man days expended for ECNs in 1978.

- Vendors interviewed reported that considerable effort has been made to reduce field installed ECNs; however, the present number in most cases is still excessive.

- Changes to the mechanical portion of electo-mechanical devices is the largest consumer of field engineering time.

- Electronic affected ECNs are being handled almost exclusively by board swaps. The faulty board is updated (or scrapped) at the repair depot or factory.

- Some vendors have reduced field installed ECNs to zero.

3. "NO FAULT FOUND" SERVICE CALLS AS A FACTOR

- Generally, the submission of an invoice on "no fault found" service calls is a management decision. Field engineers prepare a billable call report and then marketing and field engineering decide if an invoice is to be rendered.

- All companies submitted an invoice if the customer is on a maintenance contract and the call is outside of the covered period.

- Twenty-three companies (52.3%) have eliminated billing under any conditions for "no fault found" (see Exhibit V-31).

EXHIBIT V-30

PERCENTAGE UTILIZATION OF FIELD ENGINEERING TIME FOR INSTALLING "ENGINEERING CHANGE NOTICES" IN 1978 FOR RESPONDENT VENDORS

TYPE OF VENDOR	PERCENTAGE OF AVAILABLE HOURS EXPENDED			NUMBER OF RESPONSES
	HIGH	LOW	AVERAGE	
MAINFRAME	21%	1%	6.4%	5
SMALL BUSINESS COMPUTER	10	5	7.5	2
MINICOMPUTER	20	1	6.7	7
PERIPHERAL	15	1	5.6	6
TERMINAL	6	0.04	3.7	7
THIRD PARTY MAINTENANCE	11	1	6.1	5
OTHER	15	1	7.1	5
ALL VENDORS COMBINED	21%	0.04%	5.9%	37

EXHIBIT V-31

BILLING CHARACTERISTICS FOR "NO FAULT FOUND" SERVICE CALLS FOR CUSTOMERS COVERED BY MAINTENANCE CONTRACTS FOR RESPONDENT VENDORS

TYPE OF VENDOR (NO. OF RESPONSES)	-SOMETIMES- DEPENDS ON SITUATION OR CUSTOMER	NEVER BILLED (ON CONTRACT)	ALWAYS BILLED (ON CONTRACT)
MAINFRAME (6)	2	4	0
SMALL BUSINESS COMPUTER (3)	1	2	0
MINICOMPUTER (6)	3	2	1
PERIPHERAL (10)	6	4	0
TERMINAL (7)	0	6	1
THIRD PARTY MAINTENANCE (5)	2	2	1
OTHER (7)	3	3	1
ALL VENDORS COMBINED	17 or 38.6%	23 or 52.3%	4 or 9.1%

- Respondent users do not expect to be billed for service calls during periods covered by maintenance contract. They do expect to be billed for non-covered periods even if "no fault is found."

4. ANALYSIS OF FIELD ENGINEERING PRODUCTIVITY

- Respondent vendors generally agreed that 70% of the available field engineers time should be productive.

  - Productive time is defined as hours expended that can be assigned a device serial number.

  - Gross available hours are the work hours in a year less holidays, vacation, sick days, personal days off and training days.

- The available hours for productive utilization can further be reduced by:

  - "No fault found" calls.

  - Travel.

  - Installation of ECNs.

  (Note: "no fault found," travel and installation of ECNs are considered productive time; i.e., assigned to a device serial number. However, they reduce the engineer's time that could be applied to service.)

- Respondent vendors cite a need to improve in areas of:

  - Travel time which accounts for 15.5% of the average field engineers time.

  - "No fault found" calls which average 10.1% of the total calls.

- Mean time to repair.

- Installation of ECNs which are 5.9% of the average field engineers available time.

- Repeat calls which account for 10.1% of the total service calls. (Note: repeat calls are defined as call backs for the same fault previously serviced in the past two weeks.)

• Methods utilized by respondent vendors to measure productivity of effectiveness ranged from guesswork to sophisticated computer systems modeling. Some of the indices used are:

  - Billable maintenance workload per field engineer.

  - Total time expended that was assigned a serial number.

  - Total customer satisfaction.

  - Number of repeat calls.

  - Number of completed calls per month.

  - Overtime recorded.

  - Time on customer site.

  - Number of phone calls handled.

  - Field engineer attitude as measured by the customer.

  - National work index which uses overall territory averages by type of equipment to determine field engineering workload.

- Individual cost/revenue ratios.

- Profit or loss by customer. Used by some vendors with staffed on-site service accounts.

- Letters to the president.

• The trend of the vendors is towards better measurement criteria using methods not unlike the national work load index.

  - Vendors utilizing a national workload index report the following monthly averages:

    . Typical field engineering work load of 105 to 120 hours for mean time to repair, preventive maintenance and engineering change notices. This figure excludes travel, installation or discontinuance effort.

    . For field engineers in remote areas with extended travel time, a typical work load is 60 hours.

    . Field engineers in on-site situations are assigned an average work load of 160 hours.

5. SOFTWARE MAINTENANCE AS A FACTOR

• Thirty-five percent of the respondent vendors are presently providing systems software maintenance (see Exhibit V-32). An additional 6% of the respondent vendors are planning to provide systems software maintenance by 1982.

• The advent of distributed data processing was the reason cited by most vendors for the shift to systems software maintenance by field engineering.

EXHIBIT V-32

RESPONDENT VENDORS 1978 STATUS ON SOFTWARE MAINTENANCE AND PROJECTED PLANS FOR 1982 BY TYPE OF VENDOR

TYPE OF VENDOR	SYSTEMS SOFTWARE						APPLICATIONS SOFTWARE					
	DO NOW		DO NOT		DO IN 1982		DO NOW		DO NOT		DO IN 1982	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
MAINFRAME	4	57.0%	2	29.0%	1	14%	0	0%	6	75%	2	25%
SMALL BUSINESS COMPUTER	0	0	2	100.0	0	0	0	0	2	100	0	0
MINICOMPUTER	1	33.3	2	66.7	0	0	0	0	3	100	0	0
PERIPHERAL	0	0	5	83.0	1	17	1	20	4	80	0	0
TERMINAL	1	20.0	4	80.0	0	0	1	20	4	80	0	0
THIRD PARTY MAINTENANCE	1	100.0	0	0	0	0	0	0	1	100	0	0
OTHER	4	50.0	4	50.0	0	0	2	25	6	75	0	0
TOTAL	11	35%	19	59%	2	6%	4	13%	26	81%	2	6%

- Software training for field engineers represents a danger that further accelerates personnel attrition. Field engineers can receive more compensation as programmers than engineers. Programmers are in short supply and job opportunities are readily available.

- Thirteen percent of the respondent vendors provide maintenance for applications software while an additional 6% plan to provide maintenance for applications software by 1982.

- Distributed data processing was again cited as the moving force to provide applications maintenance.

- Vendors cannot agree where the traditional role of systems engineering belongs.

  - Design and installation of an application program is clearly a marketing function.

  - After the application is installed and then fails, should it be maintained by marketing or field engineering?

- Typical comments on application software maintenance by respondent field engineers are:

  - Pro:

    - "One call, one person, one fix."

    - "If it worked yesterday it's our responsibility."

    - "I don't want my field engineers to act like Ma Bell and say it's somebody else's problem and leave."

- Con:

  - "Can't be handled by the present field engineer."

  - "Requires a higher pay scale and level of people that we don't have nor could we afford."

  - "Could tie up a man for days. We aren't structured to handle that work."

F. FACTORS TO ENHANCE FIELD ENGINEERING MANPOWER UTILIZATION

1. ATTITUDES TOWARD CUSTOMER DIAGNOSING FAULTS

- Seventy-one percent of the respondent vendors desire the customer to diagnose faults (see Exhibit V-33).

- Vendors perceive that customer performed diagnostics:

  - Eliminates unneeded service calls.

  - Can be an aid in assuring the field engineer arrives at the customer's location with the proper tools and spares.

  - Saves user and vendor time.

  - Can either determine the problem location (i.e., hardware, systems software or application software) or eliminate one of the possible trouble locations.

- Vendors who do not desire the user to run diagnostics fear that the customer will try to fix it himself or start "tinkering under the covers."

EXHIBIT V-33

RESPONDENT VENDORS' ATTITUDES TOWARD CUSTOMER DIAGNOSING FAULTS

TYPE OF VENDOR	DESIRE CUSTOMER TO DIAGNOSE FAULTS	PERCENT	DO NOT DESIRE CUSTOMER TO DIAGNOSE FAULT	PERCENT
MAINFRAME	5	71.4%	2	28.6%
SMALL BUSINESS COMPUTER	2	66.7	1	33.3
MINICOMPUTER	5	71.4	2	28.6
PERIPHERAL	7	77.8	2	22.2
TERMINAL	6	75.0	2	25.0
THIRD PARTY MAINTENANCE	3	60.0	2	40.0
OTHER	7	70.0	3	30.0
ALL VENDORS COMBINED	35	71.4%	14	28.6%

2. USER DELIVERING FAULTY PRODUCT TO A REPAIR CENTER

- Forty-five percent of the vendors state that they believe the end user would deliver his faulty product to a repair site (Exhibit V-34).

  - A number of customers perform this function now with small products (i.e., modems, hand held scanner, etc.).

  - The willingness of the customer to deliver is based upon size of the product.

  - Availability of on-site spares or the capability to exist without the product is the overriding consideration in determining if a repair can be made on-site or at a remote location.

  - Some question exists as to liability for damage to the product while in transit.

3. CENTRAL DISPATCH AS A FACTOR

- Vendors are implementing centralized dispatch as a management tool for increased control. The trend is away from the field engineer keeping his own "call queue."

- Advantages:

  - Real time status as to situation at the customer site.

  - Track all calls from input to dispatch.

  - Can get today's information today.

  - Monitor response time.

EXHIBIT V-34

RESPONDENT VENDORS' PERCEPTIONS OF CUSTOMERS' WILLINGNESS TO DELIVER FAULTY PRODUCT TO A REPAIR SITE

TYPE OF VENDOR	WOULD DELIVER	PERCENT	WOULD NOT DELIVER	PERCENT
MAINFRAME	4	57.0%	3	43.0%
SMALL BUSINESS COMPUTER	1	33.3	2	66.7
MINICOMPUTER	3	43.0	4	57.0
PERIPHERAL	3	30.0	7	70.0
TERMINAL	2	25.0	6	75.0
THIRD PARTY MAINTENANCE	4	66.7	2	33.3
OTHER	6	60.0	4	40.0
ALL VENDORS COMBINED	23	45.0%	28	55.0%

- Monitor repair time.

- Monitor call backs.

- Monitor excessive calls to same site.

- Used to check spares availability.

- Can find location of spares.

- Can tie parts used to specific service calls.

- Claimed to save field time but not documented as to amount.

- Reduces service calls for non-service problems. One company reports elimination of 34% of the calls that are operator error.

• Disadvantages:

  - Expensive to implement.

  - Customer feels he has lost contact with local field engineering.

  - Field engineer feels he has lost control of his accounts.

  - Local field engineering manager may lose control of his engineers and call status unless he, too, is automated.

• One vendor who has implemented a national central dispatch states that a central district level dispatch may be preferred.

  - Better response and control from a source closer to the customer and field engineer.

- Not as complex to implement since fewer field engineers and customers are involved in each phase.

- Retain a local "flavor" and accent.

- Users must be sold on advantages to them of central dispatch. It is not a service they will request to be provided. Users are uncertain of the impact on response.

4. SYSTEMS SUPPORT CENTER AS A FACTOR

- Vendors perceive a more active field engineering role in software maintenance in the near future.

- Software maintenance requires either a massive field training program or consolidation of hardware and software specialists in a central locations.

- Vendors consider establishing a central systems support center because:

  - It is one of the few viable alternatives to accomplish the mission.

  - It can be established rapidly compared with the alternatives.

  - It is a proven operating approach.

- A vendor with a system support center has combined hardware and software specialists and:

  - Anticipates that by 1980, 66% of the technical support group will be software support, the remaining 34% will support hardware.

  - Expects the central suport center will increase from the present level of one specialist for nine field engineers to one specialist for seven field engineers by 1980.

- Reports that 99 out of 100 service calls referred to the center are handled by phone or referred to marketing who is responsible for applications software and operator training.

G. THE IMPACT OF TECHNOLOGY ON MAINTENANCE

- Respondent users agreed that rising labor costs would have the greatest impact on present maintenance techniques (see Exhibit V-35).

  - Labor costs will continue to increase causing vendors to seek alternatives for repairing equipment other than performing on-site service calls.

  - The percentage of annual maintenance rates versus product sales price has been increasing due to reduced product sales price and increasing maintenance cost. The changing ratio of these numbers has highlighted the impact of maintenance expense to the user.

- While the advent of distributed data processing was viewed as requiring one field engineer to service both hardware and system software, its impact was ranked low.

- Eighty-one percent of the respondent vendors ranked the impact of "built in diagnostics" high as a future development while coupling its feasibility with advances in technology. With declining product price the additional electronics cost for diagnostics would not be possible except for new higher performance/lower cost technologies such as the microprocessor.

- Multi-function equipment was viewed by respondents as an irritant. As an example there is less user pressure to repair one of three lightly used different function devices than there would be to repair one device that combined all three functions.

EXHIBIT V-35

RESPONDENT VENDORS' RATING OF THE IMPACT OF FUTURE DEVELOPMENTS ON MAINTENANCE TECHNIQUES

FUTURE DEVELOPMENTS	*RATING PERCENT					TOTAL RESPONSES	RANKING
	1	2	3	4	5		
RISING LABOR COSTS	1%	3%	2%	8%	30%	44	5
INCREASING PRODUCT PRICE/PERFORMANCE	8	3	6	11	5	33	-
USER PERFORMING OWN MAINTENANCE	12	5	8	6	5	36	-
VENDOR AND USER COOPERATIVELY TEST EQUIP.	7	5	5	11	8	36	1
HOME OR PERSONAL COMPUTERS	26	4	0	0	1	31	-
MULTI-FUNCTION EQUIPMENT	16	7	5	0	3	31	-
BUILT-IN DIAGNOSTICS	2	0	5	16	15	38	4
REMOTE DIAGNOSTICS	5	5	7	8	12	37	2
DISTRIBUTED DATA PROCESSING	9	8	6	4	5	32	-
ADVANCES IN TECHNOLOGY	2	2	8	10	14	36	3

*5 = GREATEST IMPACT/HIGHEST PRIORITY
1 = NO IMPACT

- Only 30% of the respondent vendors considered that the user would maintain his equipment. Other vendors cited training problems, inability to maintain skill level and lack of career path as some of the reasons the user would not maintain his own equipment.

- Eighty-one percent of the respondent vendors ranked remote diagnostics as high impact but exercised caution as to its availability. Some vendors have tried remote diagnostics and have been disappointed in its utilization by the user.

- Vendors attitudes reflected:

  - Very little can or will be done in the short term to improve the labor intensive maintenance methods.

  - Technology with prudent design engineering is the ultimate solution to the user's desire for availability.

H. VENDOR ATTITUDES TOWARD MAINTENANCE CHARACTERISTICS

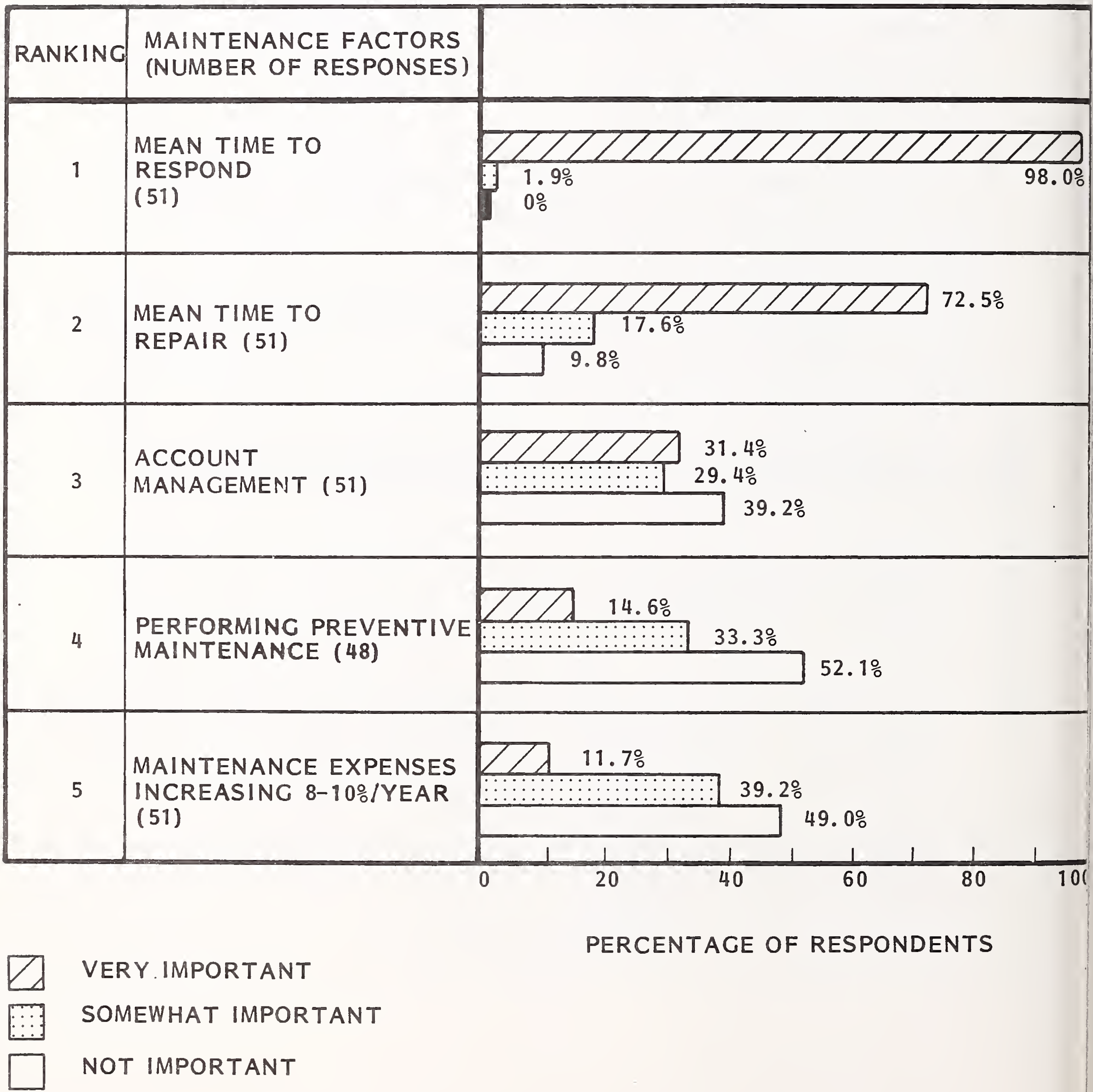
1. VENDOR PERCEPTION OF IMPORTANCE TO THE USER OF FIELD MAINTENANCE CHARACTERISTICS

- Vendors were unanimous in rating mean time to repair and mean time to respond as the most important characteristics of field maintenance (see Exhibit V-36).

- Vendors perceive that mean time to respond is more critical from a customer view than mean time to repair.

EXHIBIT V-36

RESPONDENT VENDORS' RATING OF THE IMPORTANCE TO USERS OF VARIOUS FIELD MAINTENANCE FACTORS



INPUT

- Account management was rated somewhat important indicating a desire to exercise more influence at the customer site and a need to achieve better customer relations for field service.

- Forty-nine percent of all vendors rated increasing maintenance expenses as not important. Vendors correctly perceive that the quality and method of maintenance delivery is far more important to the user than cost of service.

- Fifty-two percent of all vendors rated preventative maintenance as not important. Preventive maintenance was rated as unimportant by 87.5% of the peripheral and 71.4% of the terminal vendors.

  - Vendors perceive that PM has been oversold to the user and that the user is aware that it is not effective in reducing downtime on all devices.

2. SELF RATING OF VENDOR'S PERFORMANCE

- Respondent vendors tended to rate their performance of field maintenance characteristics as better than competition (see Exhibit V-38). For all characteristics combined only 8.9% of the respondents stated a rating poorer than competition.

  - For mean time between failures, those interviewed were most self-critical with 15.7% reporting they were poorer compared to competition (see Exhibit V-37).

  - As shown in Exhibit V-38, 80% of mainframe vendors, the leading category, rated themselves better than competition for mean time to repair.

  - Among all categories, respondents believe their response time surpasses competition (76.7%) and correspondingly, less than 5% report being worse than competition (see Exhibit V-39).

EXHIBIT V-37

RESPONDENT VENDORS' RATING OF THEIR MEAN TIME BETWEEN FAILURE COMPARED TO COMPETITION

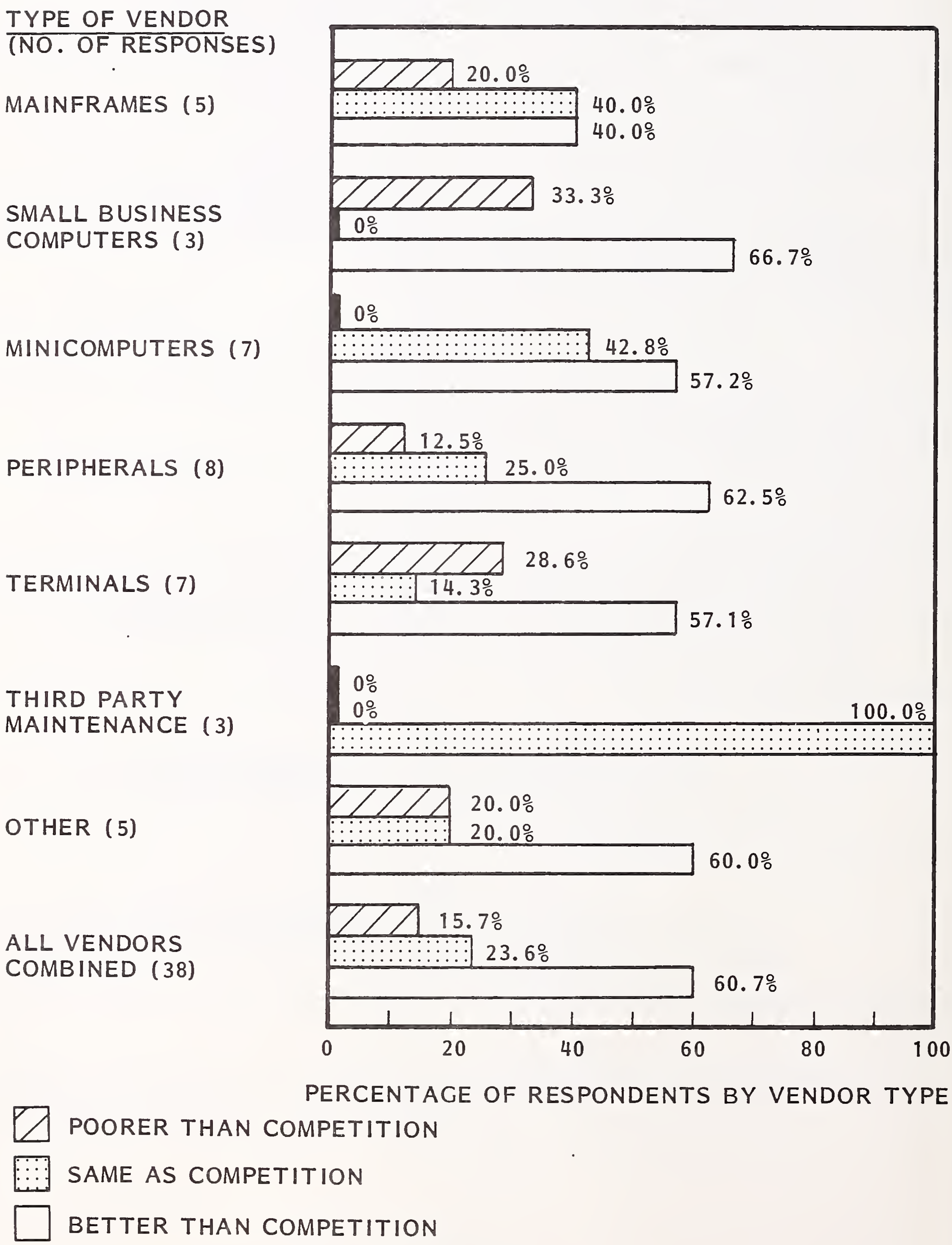


EXHIBIT V-38

RESPONDENT VENDOR'S RATING OF THEIR MEAN TIME TO REPAIR COMPARED TO COMPETITION

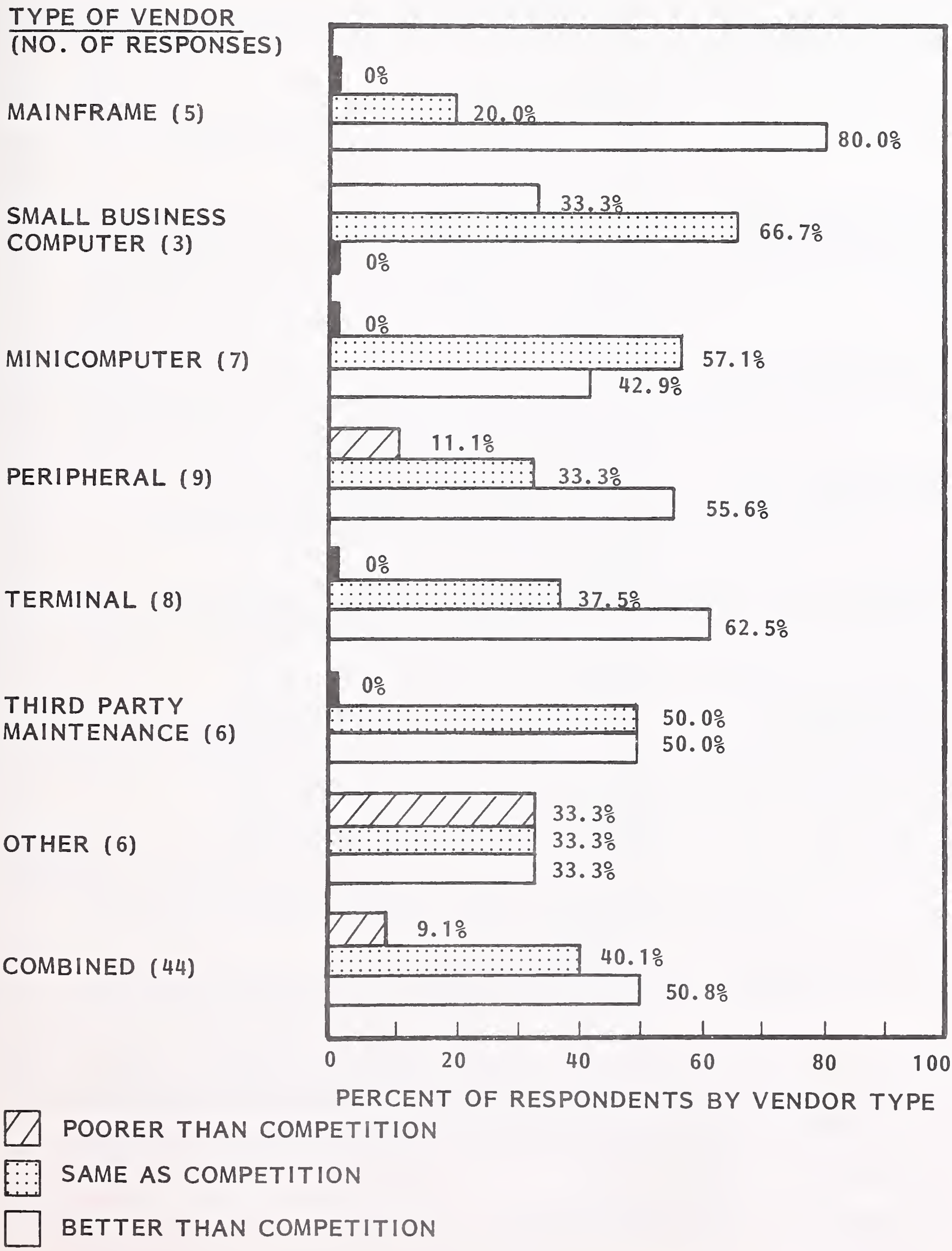
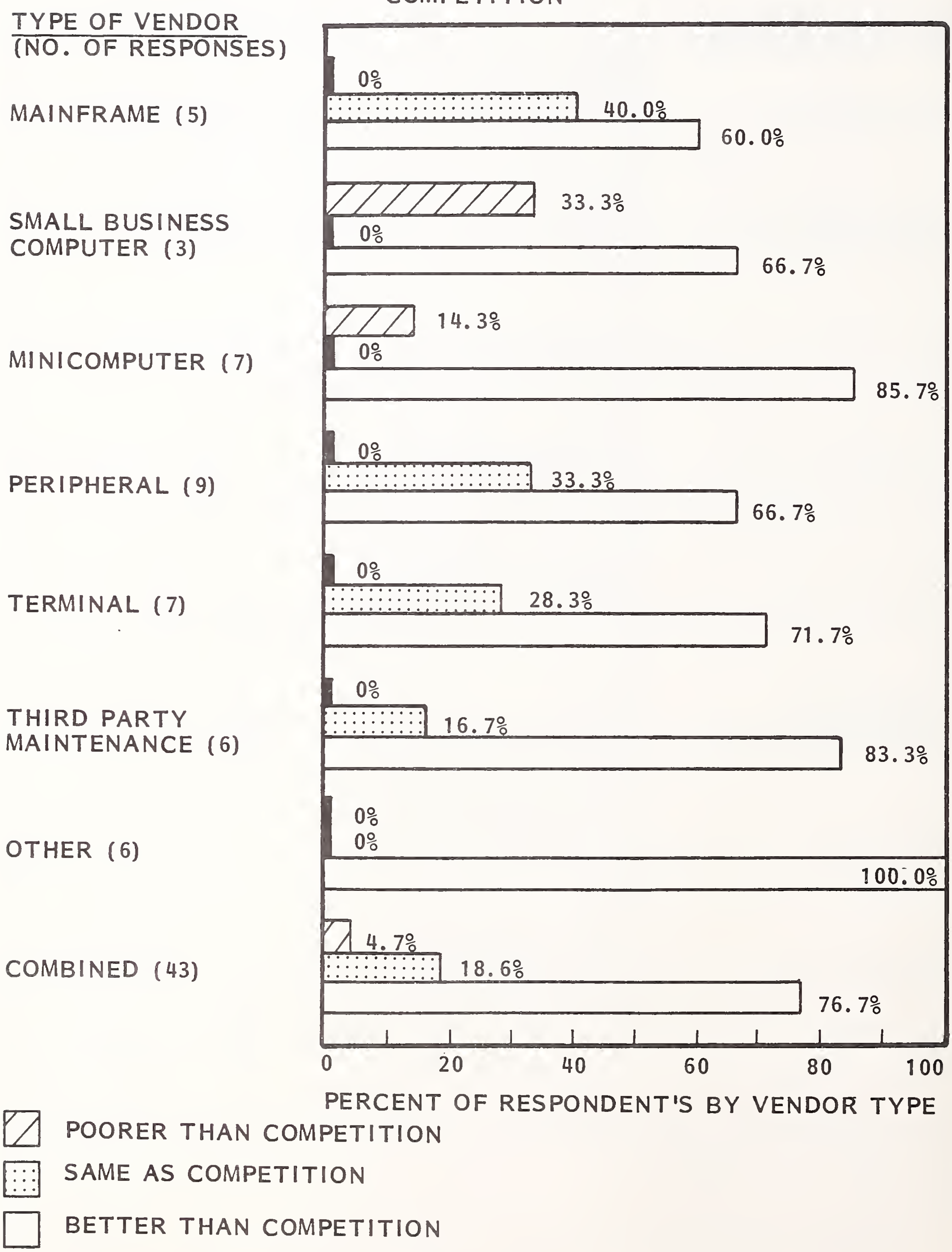


EXHIBIT V-39

RESPONDENT VENDORS' RATING OF THEIR MEAN TIME TO RESPOND COMPARED TO COMPETITION



- Exhibit V-40 shows that terminal vendors are critical of their company's performance with 62.5% believing they are equal to or poorer than competition.

- All types of vendors interviewed overwhelmingly (71-100%) report surpassing competition for total customer satisfaction (see Exhibit V-41). Respondents appear self-critical in analyzing individual measures of performance; however, they won't admit being inferior overall.

- The vendors' perception of offering maintenance service that is superior to his competition is founded on the presumption of increasing product sales. In an expanding market sales increases do not necessarily reflect satisfied customers vis-a-vis service.

- Few vendors have an active organized program to measure competition and its effectiveness in achieving maintenance goals.

  - In most cases, competitive analysis is dependent on field input.

  - Direct customer input can and is often distorted by:

    - The gracious nature of the individual who doesn't like to make negative comments.

    - The desire to receive more favorable service by emphasizing the positive virtues of service from others.

- Respondent users did not rank all vendor service as being equal.

3. REPORTED HARDWARE AND MAINTENANCE PERFORMANCE

- Vendors reported a wide range of mean time between failures (see Exhibit V-42). Their response was based upon experience for specific machine types and utilization. Some of the factors affecting the range are:

EXHIBIT V-40

RESPONDENT VENDORS' RATING OF THEIR PERSONNEL TURNOVER COMPARED TO COMPETITION

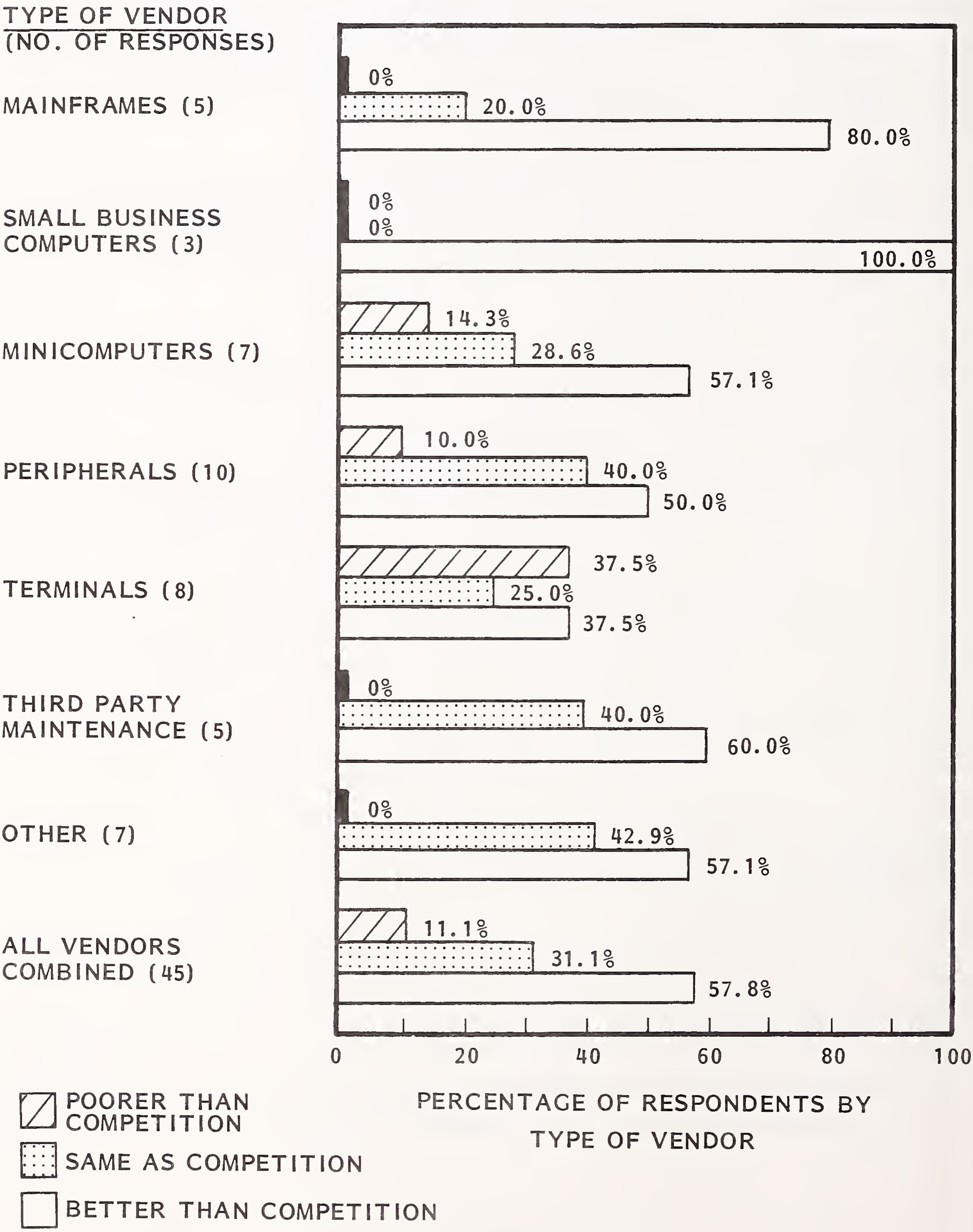


EXHIBIT V-41

RESPONDENT VENDORS' RATING OF THEIR TOTAL CUSTOMER SATISFACTION COMPARED TO COMPETITION

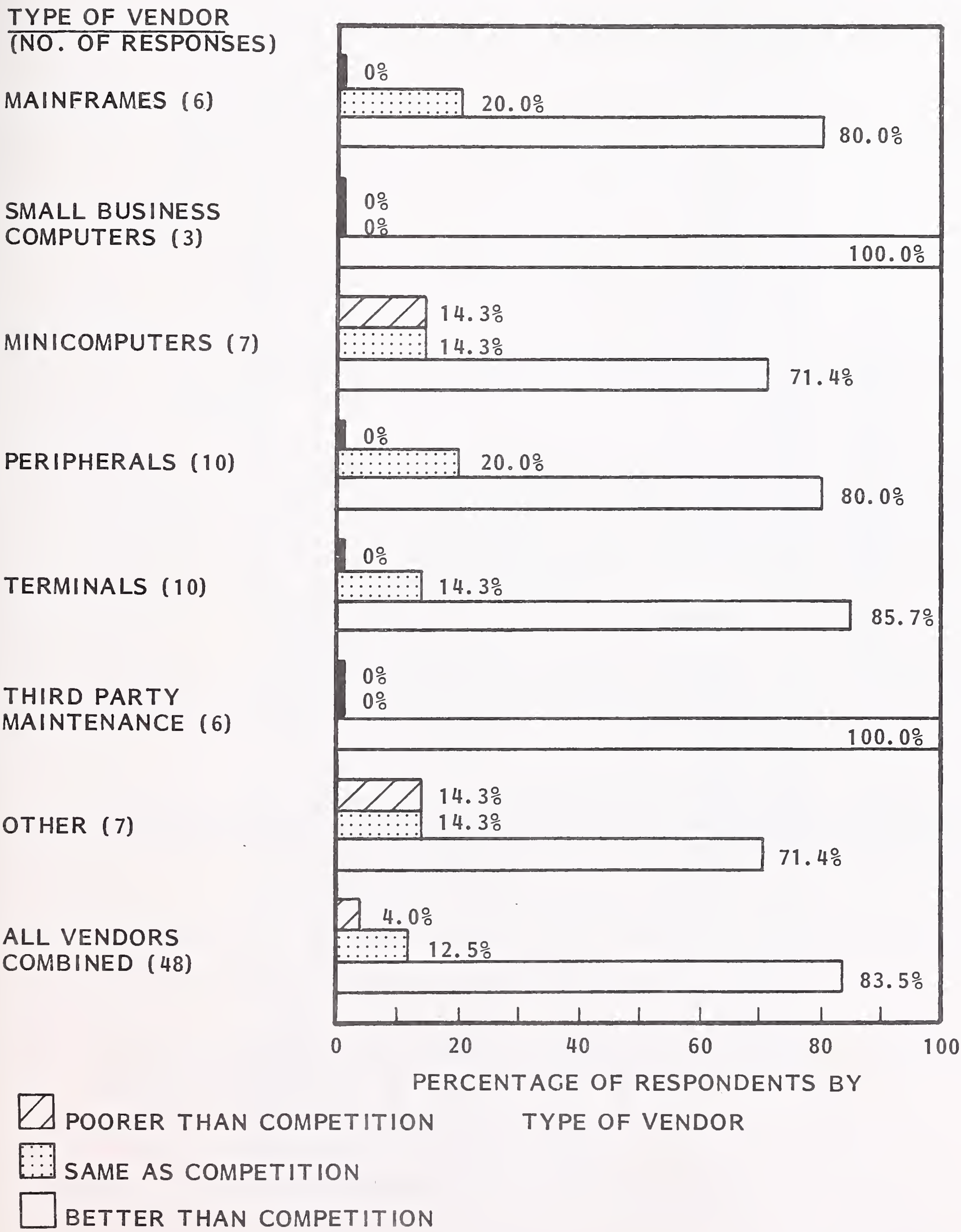


EXHIBIT V-42

REPORTED HARDWARE AND MAINTENANCE PERFORMANCE OF RESPONDENT VENDORS

TYPE OF EQUIPMENT	PERCENTAGE UPTIME (%)			MEAN TIME BETWEEN FAILURES (HOURS)	MEAN TIME TO RESPOND (HOURS)			MEAN TIME TO REPAIR (HOURS)		
	53 RESPONDENTS			RANGE	64 RESPONDENTS			64 RESPONDENTS		
	HIGH	LOW	AVG.		HIGH	LOW	AVG.	HIGH	LOW	AVG.
MAINFRAME	98.5%	95.0%	97.1%	52-3,000	4.0	1.0	2.0	6.0	0.5	2.0
SMALL BUSINESS COMPUTER	98.5	90.0	95.3	100-4,000	4.0	1.3	2.4	7.0	1.0	2.5
MINICOMPUTER	99.0	95.0	97.3	107-6,000	4.0	1.8	2.8	4.0	1.0	2.3
PERIPHERAL	99.8	88.0	96.1	24-12,000	6.0	1.0	2.6	3.0	0.5	1.6
TERMINAL	99.0	90.0	95.5	150-4,000	24.0	1.0	5.0	2.0	0.5	1.1
OTHER	99.9	92.0	95.9	10-9,000	12.2	0.5	3.7	8.0	0.5	2.9
ALL VENDORS COMBINED	99.9%	88.0%	96.2%	10-12,000	24.0	0.5	3.27	8.0	0.5	1.9

- The low hours between failures on mainframes related to older equipment and complex configuration (e.g., triplex on-line communication systems).

- The low hours on small business computers and minicomputers were due to printers and complicated to some extent by software.

- The high numbers on peripherals related to plug compatible memories and the low numbers to older disk files.

- The high number on terminals related to solid state units with keyboard and CRT only.

- The low numbers on "others" related to large electo-mechanical devices.

- Third party maintenance firm responses are distributed by the type of equipment and not shown as a group. However, the composite averages reported by third party maintenance companies is 2.9 hours mean time to respond and 2.6 hours mean time to repair.

- Terminal vendors reported the most extended mean time to respond and were second in average monthly calls per field engineer with 38.4.

I. PRESENT PROBLEMS ENCOUNTERED IN THE MAINTENANCE OPERATION

- Two-thirds of respondent vendors rated recruiting of field maintenance personnel as their "number one" problem (see Exhibit V-43).

- Vendors agreed that hiring, training, and reducing labor turnover were creating great difficulties.

EXHIBIT V-43

RESPONDENT VENDORS' RATINGS OF THE IMPORTANCE OF PROBLEMS IN THEIR ORGANIZATIONS

PROBLEM	NUMBER OF RESPONSES-RATING					RANK
	5	4	3	2	1	
MORALE OF THE MAINTENANCE FORCE	3	10	19	8	4	-
RECRUITING FIELD MAINTENANCE PERSONNEL	18	4	3	8	12	5
TRAINING FIELD MAINTENANCE PERSONNEL	11	5	10	11	9	3
REDUCING LABOR TURNOVER	11	11	9	9	4	4
PRODUCT QUALITY	7	11	12	8	6	-
ADEQUATE DIAGNOSTIC EQUIPMENT	10	8	10	9	7	2
ADEQUATE REMOTE DIAGNOSTIC ASSISTANCE	4	21	6	9	2	-
MARKETING DEMANDS	6	11	6	12	10	1
CUSTOMER DEMANDS	9	4	7	16	8	-
BUDGET LIMITS	3	16	12	9	4	-
SALARY ADMINISTRATION	3	7	16	11	7	-

5 = HIGHEST PRIORITY

1 = LOWEST PRIORITY

- Thirty percent of the respondent vendors rated product quality as received from manufacturing as an important problem. Typical comments were:

  - "If there is such a thing as distributed data processing, then I am running distributed manufacturing. The quality of the product is poor."

  - "A good product can make any field engineering operation look good and a good field engineering force can make a poor quality product look good. But we are just average in both areas."

- Thirty-nine percent of the respondent vendors are displeased with the present availability of testing equipment. Some representative comments are:

  - "Present test equipment requires too high a level of technical knowledge to operate."

  - "Scope probes cause more problems than they fix."

  - "FEs are using the scopes as big volt/ohm meters."

  - "Test equipment should be portable, have easy to read displays, and be useable by a lower level of technicians."

  - "Present test equipment companies, the big ones, only want to build equipment that has a scope or frequency counter in it. We had to design our tester and have it built by a small firm."

- Forty-five percent of the respondent vendors were experiencing problems in salary administration. The core of this problem related to proper classification of personnel to qualify for increasing salaries.

VI COMPARISON OF VENDOR AND USER RESPONSES TO COMMON SURVEY QUESTIONS

VI COMPARISON OF VENDOR AND USER RESPONSES TO COMMON SURVEY QUESTIONS

- Respondents were in general agreement on all common questions except:

  - The need for preventive maintenance (PM).

    - Vendors provided a low rating as a maintenance characteristic. However, less than 20% of the users rated PM low in importance.

    - The users, while not convinced of the value of preventive maintenance, fear that reduced PM on their part would provide the vendor an excuse for poor service.

    - Field engineering perceives that marketing has oversold the value of PM's role in reducing unscheduled downtime.

  - The importance of account management as a maintenance characteristic.

    - Users perceive account management to be a more important maintenance characteristic than do vendors.

- Those vendors selling account management have achieved success in convincing users of its value. Vendors without an account management program do not understand its value and rank it low.

- Increasing maintenance expenses.

  - Fifty percent of the vendors and 20% of the users ranked increasing maintenance expenses as unimportant.

  - users become interested in maintenance expense only when they note the level of service slipping. They feel that, given the price they pay, service should be better. However, good service can demand a good price.

A. IMPORTANCE OF MAINTENANCE CHARACTERISTICS

- Users and vendors agreed that mean time to respond and mean time to repair were the most important aspects of maintenance service.

  - Users and vendors rank mean time to respond as more important than mean time to repair.

  - Users are irritated by vendors who quote a two hour response time and then consider a returned phone call during this period to establish a time for the field engineer to arrive as responding. Users consider mean time to respond as being on-site arrival "in person."

- Performance of preventive maintenance is a subject of disagreement between end users and vendors. Over half (52.1%) of the respondent vendors rated preventive maintenance as unimportant compared to only 19% of the end users.

- User and vendor opinions on PM range from very important to not required.

- Preventive maintenance was rated as unimportant by 87.5% of peripheral and 71.4% of terminal vendors.

- The majority of the end users expressed a willingness to discuss preventive maintenance and follow the recommendations of the vendor.

• Account management was ranked important by 31.4% of the respondent vendors and 38% of respondent end users.

  - Third party maintenance and mainframe companies ranked account management very important; 66.7% and 57.1% respectively.

  - All categories of users except "large" users rated account management as important.

• Increasing maintenance expenses were ranked as unimportant by 49% of the respondent vendors and by only 20% of the end users. However, increasing expenses were ranked very important by only medium sized users.

• Vendors have been successful in selling account management as a concept to very large users. More sales effort is needed for the large users. Account management must be sold as a method to improve user availability.

• Marketing and field engineering must determine their positions on preventive maintenance. If it is a required function it must be sold to the user. If it is not required, then vendors should create a program to disengage.

• The quality of service has diminished, and the users' concerns about spare parts shortages and maintenance costs are increasing. Vendors owe users an explanation as to the status of maintenance in general and their installations specifically.

B. ACTIONS REQUIRED TO IMPROVE SERVICE

- Vendors and end users agree that the quality of service is deteriorating. The basic reasons for this situation are the expanding marketplace and the shortage of qualified personnel.

- Both vendors and users offered the following suggestions to improve service:

  - Increased quantities of spare parts on the customers' premise or in the local branch office.

  - Better training of field engineers as it relates to troubleshooting.

  - Improved public relations on the part of the field engineers, such as informing the proper customer representative when the field engineer arrives and reporting the situation and status when he leaves.

  - Improved factory quality control and final systems qualification.

- The respondent vendors also cited several actions that would improve maintenance.

  - Account management: it aids the customer in understanding the maintenance situation for his installation.

  - Increased field engineering involvement in the pre-sales activity.

  - Expanded utilization of remote diagnostics as a tool to reduce mean time to repair.

  - Increased number of product specialists.

- Less emphasis on selling preventive maintenance and more allowance for field engineering to improve service on trouble calls.

- More customer education on the maintenance function.

- Better application software documentation by the customer.

- The comments and ratings relative to the common survey question revealed a high degree of correlation among the respondent users and vendors as did their projections for the future.

  - Respondent users reported 17.9% utilized third party maintenance service on one or more devices; vendors reported 17.1% of their equipment was maintained by third party firms.

  - Users reported 1979 expenditures for information processing maintenance charges would increase 15.4% over 1978. Vendors projected an increase in maintenance revenues of 15.3% for the same period.

  - Users projected an increase of 24% in expenditures for the period 1978-1980. Vendors forecasted an increase in maintenance revenue of 23% for the same period.

  - Users projected an increase of 34% in expenditures for the period 1980-1983. Vendors projected an increase in maintenance revenues of 36% for the same period.

  - Users reported that the percentage of their information processing budget for maintenance would change slightly. However, the dollars expended would increase as the budget increased.

VII THE COMPETITIVE ENVIRONMENT

VII THE COMPETITIVE ENVIRONMENT

- The exhibits in Chapter III reflect the user's perception of maintainability and reliability as factors in selection of a hardware vendor.

  - If all equipment performed the same functions and was sold for the same price the user would always select IBM based upon reliability, availability, and serviceability.

  - The level of expected maintenance service portrays a more dominant role in selection of equipment where IBM is considered an alternative. Where IBM is a factor (e.g., Series/1), its maintenance capability enables IBM to overcome large price gaps.

- In Chapter V, the respondent vendors were asked to rate their level of maintenance service against competition. Only 4-15% of the vendors considered their maintenance service poorer than competition.

- Respondent users rated the service provided by their maintenance vendors and ranked this service where multiple vendors were involved (see Exhibit VII-1). (Note: Vendors for which there was no response are indicated by (-). Zeros (0) represent only medium or high ratings that were assigned such as Amdahl and Univac. The exhibit refers only to vendors mentioned by the user interviewed and is not all inclusive. User dissatisfaction is reported; e.g., of all users, those mentioning NCR perceived their equipment was out of service the most (100%) compared to other vendors in their shop; 12% felt that NCR did a poor

EXHIBIT VII-1

RESPONDENT USERS' RATINGS OF VENDORS' MAINTENANCE PERFORMANCE

MAINTENANCE VENDOR	EQUIPMENT OUT OF SERVICE THE MOST (%)	PERCENTAGE OF LOW RATINGS ON TOTAL MAINTENANCE TASK	PERCENTAGE OF LOW RATINGS ON PREVENTIVE MAINTENANCE
IBM	21%	6%	11%
MEMOREX	16	16	25
BURROUGHS	66	29	25
DEC	66	25	40
AMDAHL	0	0	0
HONEYWELL	50	15	30
UNIVAC	0	0	0
COMMA/CDC	50	14	21
SORBUS	0	17	12
NCR	100	12	50
ITEL	100	16	0
H-P	25	20	25
FOUR PHASE	0	18	20
DATAPOINT	-	24	33
CMC	0	12	0
HARRIS	-	12	33
STC	-	3	0
TELEX	85	50	60
RAYTHEON	-	25	50
CALCOMP	-	66	25
REI	33	0	0
ENTREX	-	50	60
INTEL	100	33	0
XEROX	-	25	0
DATA GENERAL	-	50	100

job on total maintenance and 50% believed NCR did a poor job on preventive maintenance.)

- The IBM acronym RAS (reliability, availability, serviceability) may or may not be a functional program. However, 94% of the respondent users approved of the level of IBM service. Considering the vast number of installations it requires more than a competent service organization to achieve that level of satisfied users.

- Only 42 of the 145 respondent users had replaced hardware within the last two years.

  - Action taken to replace vendor equipment due to deficient maintenance has a long-term effect on the attitudes of the user personnel involved.

  - Although few users refused to state that the vendor of replaced equipment would not be considered in future procurements, their attitudes were that of "...it would take considerable proof that service has improved before we would buy again."

  - Local marketing efforts can be hampered when equipment is removed from a site for maintenance service reasons.

  - Despite changing attitudes, users are often reluctant to select equipment other than IBM. The level of maintenance service is an important contributing factor to this attitude.

- IBM has established a maintenance service standard for the industry against which vendors will be measured.

- Users desire availability not maintenance. However, due to the state of the art in electronics, the vehicle for availability today is not via engineering as it will be in future products but through maintenance service. The user's desire for availability is perceived as being achieved through service until products are reliable enough to be trouble free.

- Exhibit VII-2 reflects the respondent's attitudes via comments as to specific vendor service.

EXHIBIT VII-2

USER COMMENTS

"REI changed FEs about one year ago and the new engineer isn't very good."

"In some ways we lost ground in the change away from IBM."

"It seems IBM has some problems getting parts in remote locations."

"Sycor is the worst of the three (Datapoint, Courier) as far as level of support provided."

"Sycor service is spotty. Good in some areas and bad in others."

"Memorex requires pushing by the user."

"Xerox falls down sometimes on long MTTRs."

"STC is really good."

"HP is very slow."

"Harris has had some turnover in personnel. Service is beginning to improve."

"Had CDI on contract and had no calls for a year and switched to time and material."

"We're not too happy with IBM right now."

"Burroughs corporate support inadequate. Underpaid CEs are not competent. Service quality is low. Account control is poor and response is slow. They have inexperienced help in Europe."

EXHIBIT VII-2 (contd.)

"Service from all my vendors is really very good - IBM, Four Phase, CDC, Harris, and Raytheon."

"The Geneses has never needed service."

"Reason we have IBM equipment is because of their maintenance."

"IBM's CEs are not very good but their backup troubleshooters are outstanding."

"No problem at all with NCR."

"Don't give Telex a low rating - they think I am just mad."

"New terminals from IBM (3278) didn't have parts available."

"Telex has some problems right now."

"Our IBM equipment is old and we use Comma. When we upgrade we will use IBM service, it's better."

"(We) would pay more for maintenance if our management of the maintenance effort could be reduced."

"The communications department maintains Raytheon terminals. With so many centrally located terminals its prudent to maintain their own to keep the level of performance up."

"(We) have some experience with Sorbus and other third parties. (They) do not appear to have the same commitment as the vendor. When field engineering works in the sales department, it is a good lever for good maintenance."

"(It's) difficult to separate software and hardware maintenance. Software is a large area of concern."

"Bell (AT&T) doesn't put out equipment unless it has high reliability."

EXHIBIT VII-2 (contd.)

"Willing to pay the IBM price. No third party."

"REI equipment is difficult to maintain because there is so much to go wrong."

"Maintenance on minis--vendors do what they have to do and no more. It's a buyer beware market."

"No third party. (We) wouldn't buy equipment that a vendor couldn't maintain."

"(We) only use vendor maintenance except when forced to third party by a leasing company."

"(We are) willing to pay 100% more for terminal maintenance. Alternative is duplicate equipment."

"Memorex front ends are less complex than others and down the least."

"Wary of Memorex, particularly in disks/tapes - but would not refuse to consider."

"Bad experience with Telex - use only vendor now for maintenance, no third party."

"In the process of replacing Intel memory because of Telex service."

"Wouldn't consider third party again."

"Prefer vendor on-site CE."

"Third party is OK for small stuff."

"Use Sorbus only because Intel doesn't have field service."

"Use Sorbus for EMM memory. Not much experience with third party but have been pleased with Sorbus."

"Would not consider third party unless it was a very reputable national company with service at IBM's level."

EXHIBIT VII-2 (contd.)

"Telex people aren't that bad - there just aren't enough of them."

"I wouldn't refuse to consider anybody - not even Telex."

"Only use third party if, and only if, no service in the area by manufacturer."

"Using vendors (we) are assured the field engineer is qualified."

"(We) would avoid third party. I wouldn't buy equipment from a vendor that couldn't maintain it."

"Only use third party if no manufacturer's service (if available)."

"When I had this system installed I hired a third party group and it took them eight hours. IBM estimated two to three days."

"REI is too complicated for anyone except REI to maintain."

"(We) have ten people to install and maintain GT&E and General Data Communications multiplexer and modems. Cheaper and more responsive than any other approach."

"Replacing Telex terminals."

"(We) do not use or plan to use third party."

"Wouldn't let Sorbus on-site. (We) no longer use Sorbus or would we consider using them."

"(We) maintain packet switch and video terminal controllers with our own people. Have people and can get better response time."

"Use IBM reliability plus program to determine when equipment needs PM. Should go back to regular schedule."

EXHIBIT VII-2 (contd.)

"I hesitate to use third party because vendor service is so good. (We) would talk to third party but (we) would be hard to convince to switch."

"Calcomp maintenance is terrible, yet, in trying to arrange a third party we discovered that Calcomp charges such high prices for parts it prevents third party firms from encroaching on their maintenance (base)."

"Honeywell has almost no secondary market because they charge so much for service."

"Considering Comma for the future."

"Cambridge memories are maintained by Raytheon -- Raytheon hires people away from competition but (they are) not kept up to date -- inadequate documentation -- Had to wait 38 hours this month for parts -- average 34 calls a month for service -- (they) never show up for PM."

"(We) never had any experience with third party nor would I consider."

"(We) wouldn't consider third party just for cost reasons."

"(We) would consider third party but no one around that can handle Burroughs properly."

"I don't like sub-lease maintenance such as Intel to Sorbus. I probably wouldn't get equipment again after this Sorbus/Intel arrangement that wasn't maintained by the vendor."

"Would not consider Intel again if Sorbus is the maintenance vendor."

"Sorbus people are not well trained on Intel memory."

"I refuse to use Raytheon again. Terrible response time. Always finger pointing and saying its not their equipment that's causing the problem."

EXHIBIT VII-2 (contd.)

"(We) would not use Telex again."

"(We) would like to have one vendor do all maintenance in an effective manner."

"Honeywell is down so much they never get to do PM."

"(We) always had Univac. Wouldn't consider third party."

"(We) would refuse to do business with NCR because of (our experience with a) cash register device."

"Have NCR POS -- considering doing our own maintenance."

"NCR's PM makes problems, doesn't help."

"Couldn't keep GTE/NOVAR or Diablo terminals running -- wouldn't consider them again."

"Burroughs needs to do more PM and IBM less."

"Wouldn't have Telex back."

"I would refuse to consider Calcomp again, we had their 3330 disks and they were unreliable and the FE was poorly trained."

"Never consider Telex tape drives again."

"Telex service is as good as IBM, it comes through Sorbus."

"(We) did try third party for awhile but when we upgraded we switched to the vendor. Very satisfied with third party but they wouldn't handle the new equipment."

"We would switch to third party for the same level of service we get now (IBM) for 50% cost savings."

"(We) probably wouldn't consider third party for cost reasons. Cost isn't the most important."

"(We) wouldn't use third party -- willing to pay for IBM service."

"(We) would not refuse to consider any vendor but would prefer to stay away from NCR."

"(We) would not consider NCR again."

"(We) would refuse to consider Burroughs tapes or printers."

"Burroughs spends an excessive amount of time on PM -- 14 hours per week."

"Switching to IBM, not pleased with Burroughs."

"(We) would not consider CDC disks again."

"(We) would consider third party for improved availability of parts and good people."

"Based on (our) location and lack of other vendors in the area, we would only use IBM. Wouldn't take a chance with a smaller organization."

"I wouldn't consider a third party as cost is not the main consideration."

"I would consider third party for savings, quality service and convenience."

"I wouldn't consider Hazeltine. Poor products, but maintenance was OK. Couldn't keep it running."

"TAB keypunch and verifier service is poor, considering switching to IBM."

"Datapoint service is poor but tolerable, bad on PM."

"(We) had Sorbus until last January. Happy to be back with IBM."

EXHIBIT VII-2 (contd.)

"Datapoint isn't large enough to give good service."

"(We) would not consider Memorex disks or Telex tapes again."

"(We are) not happy with IBM but where we are located not much choice (remote). Never dealt with a third party and none around here."

"(We) wouldn't consider CDC memory again."

"Memorex printer is terrible, being replaced with IBM."

"CMC has provided good service but losing a lot of good engineers lately."

"(We are) having problems with Intel ICE-85. Long response time and get inaccurate information as to how unit works. Wouldn't consider them as a vendor again."

APPENDIX A: DEFINITIONS

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DISTRIBUTED DATA PROCESSING - Distributed processing is the deployment of programmable intelligence in order to perform data processing functions where they can be accomplished most effectively, through the electronic interconnection of computers and terminals, arranged in a telecommunications network adapted to the user's characteristics.

ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.

ENGINEERING CHANGE ORDER (ECO) - The follow-up to ECNs which include parts and a bill of material to affect the change in hardware.

FIELD ENGINEER (FE) - For the purpose of this study, field engineer, customer engineer, serviceman, and maintenance man were used inter-exchangeably and refer to the individual who responds to a user's service call to repair a device or system.

MEAN TIME TO RESPOND - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.

MEAN TIME TO REPAIR - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.

MEAN TIME BETWEEN FAILURES (MTBF) - The elapsed time between hard failures on a device or a system.

APPENDIX B: RESEARCH METHODOLOGY

APPENDIX B: RESEARCH METHODOLOGY

- The research for this study was predicated upon two sets of questionnaires, one for vendors and one for users, developed by INPUT with the aid of the client charter subscribers.

- Interviews were conducted both by telephone and on-site (see Exhibit B-1).

  - Twenty percent of the 145 end user interviews were conducted on-site.

  - Fifty percent of the 51 vendor interviews were conducted on-site.

- Telephone screening methods were employed to arrange the on-site interviews with senior people who could speak with authority regarding maintenance.

- The end user interviews were selected on a random sample basis within industry sectors and further refined to achieve sampling by size as measured by annual sales revenue or its equivalent (see Exhibit B-2 and B-3).

- The industry sectors selected were manufacturing and distribution, banking and finance, utilities, federal, state and local governments and "other."

- Twenty-nine of the 145 user interviews were conducted on-site by senior personnel.

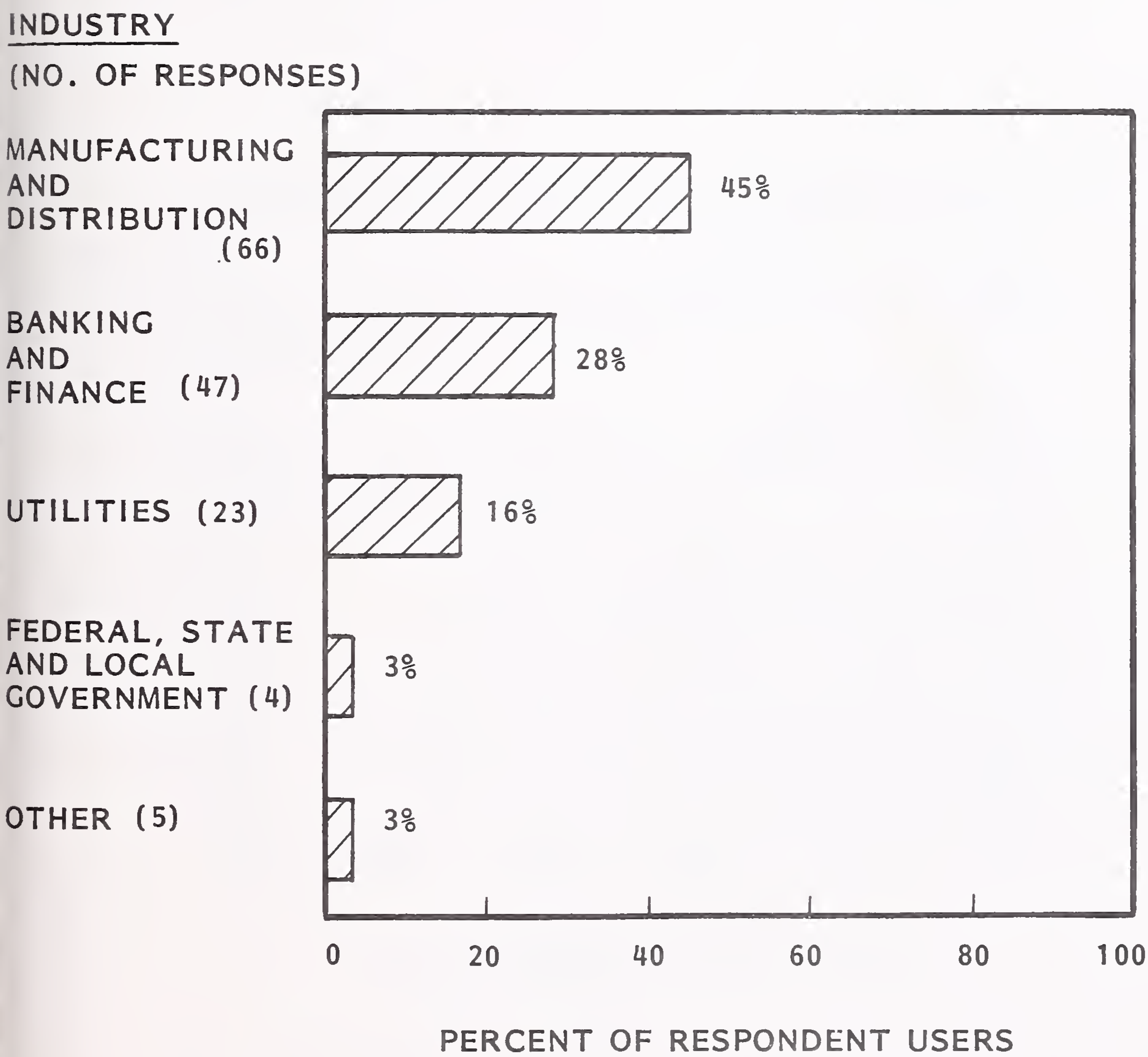
EXHIBIT B-1

INTERVIEW METHOD

RESPONDENT	ON-SITE	TELEPHONE	TOTAL
USER	29	116	145
VENDOR	25	25	50
TOTAL	54	141	195

EXHIBIT B-2

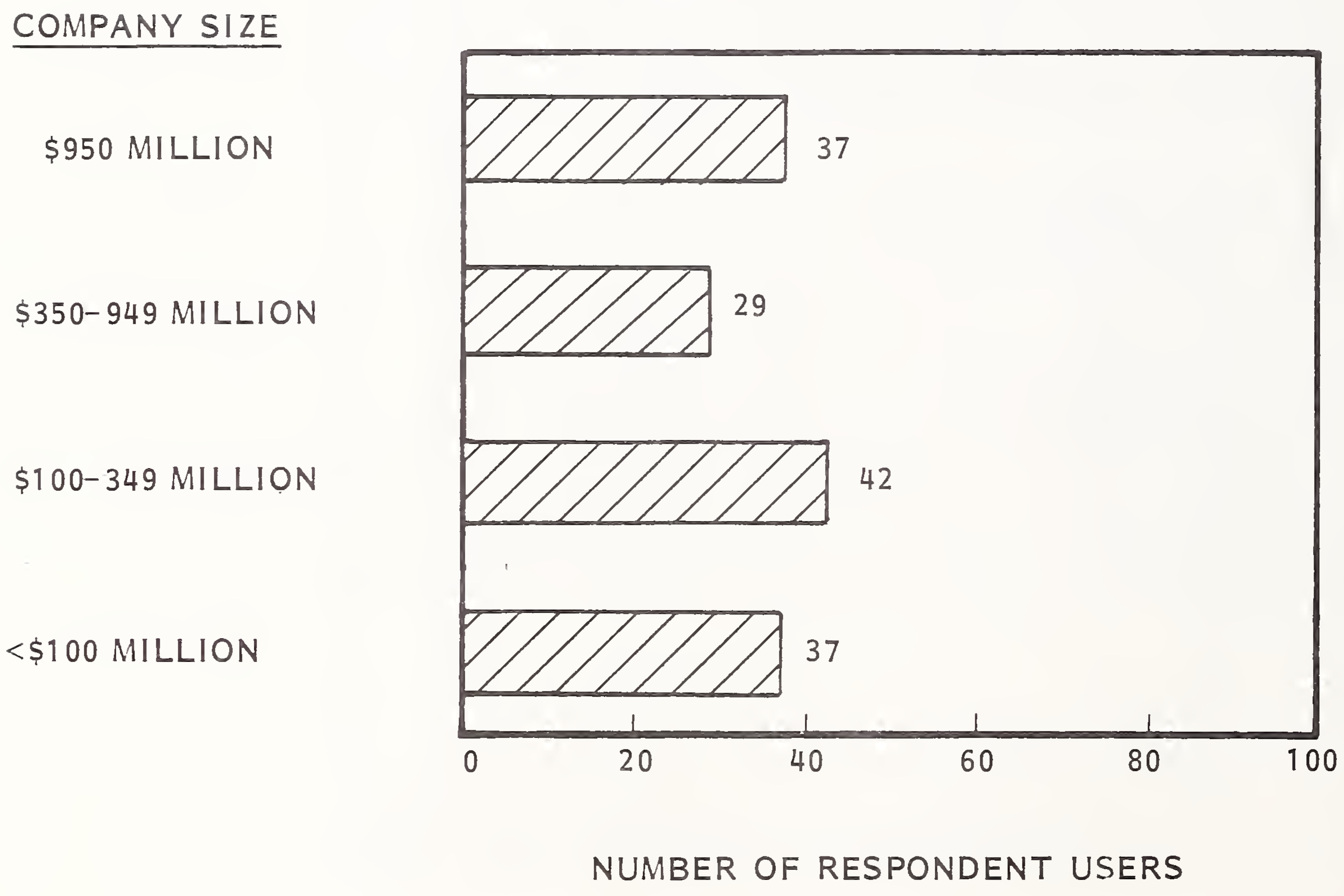
PERCENT OF RESPONDENT USERS BY INDUSTRY SECTOR



NUMBER OF RESPONSES-145

EXHIBIT B-3

NUMBER OF RESPONDENT USERS BY COMPANY SIZE



NUMBER OF RESPONSES-145

- Vendor and user on-site interviews required up to four hours to complete. Telephone interviews ranged from 45 minutes to one and one-half hours.

- In the larger vendor companies it was often necessary to interview several individuals to clarify the responses and accumulate complete information.

- Vendors were selected based upon size and major product types, such as medium and large mainframes, small business computers, minicomputers, peripherals, terminals and "others" (see Exhibit B-4).

    - "Other" includes manufacturers of OCR/MICR, intelligent terminals, factory data collection equipment, plus such non-manufacturing entities as systems integration and computer services vendors.

- Twenty-five of the 51 vendors surveyed were on-site interviews conducted by senior personnel.

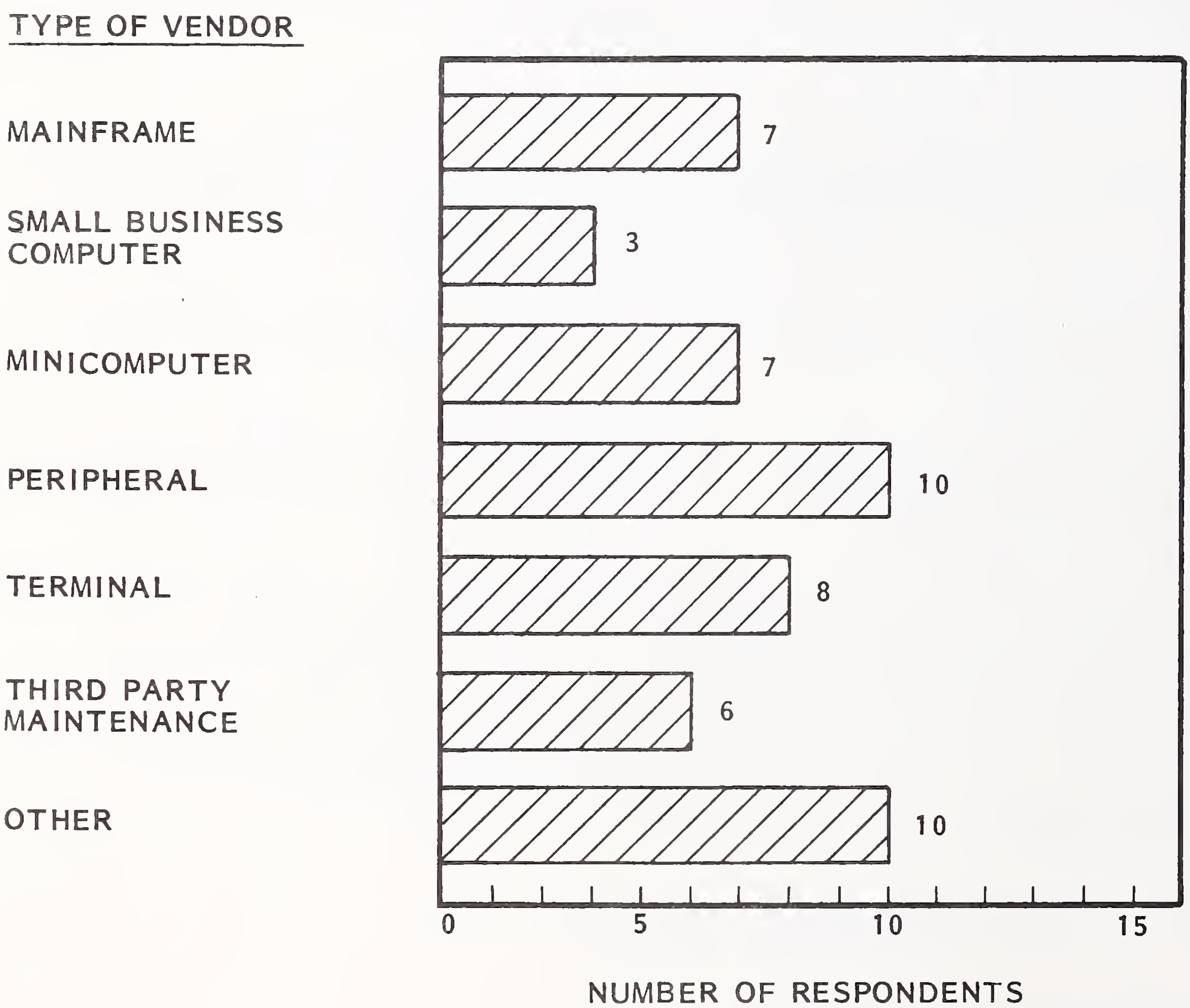
- Excluding IBM, the respondent vendors represented 55% of the total maintenance revenue income.

- The focus of the interviews was to determine representative user and vendor attitudes and experience rather than to construct a statistically valid sample. Accordingly, other market related information developed by INPUT, or available in the public domain, was used in constructing market estimates and forecasts.

- Client inquiries and comments are solicited.

EXHIBIT B-4

NUMBER OF SURVEY RESPONSES BY TYPE OF VENDOR



NUMBER OF RESPONDENTS-51

APPENDIX C: SUPPORTING CHARTS

EXHIBIT C-1

AVERAGE ALLOCATION OF RESPONDENT USERS' INFORMATION PROCESSING BUDGET, 1978

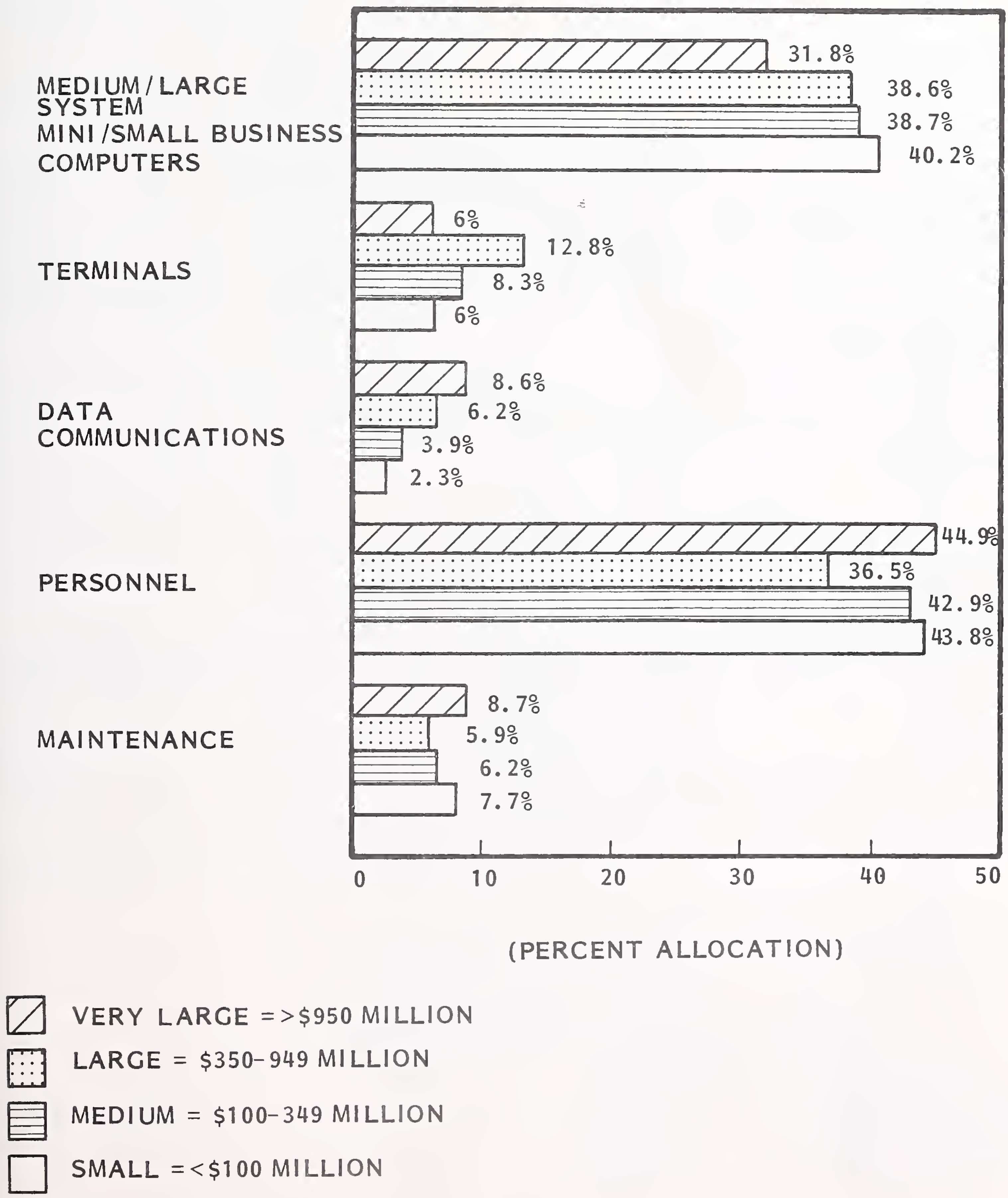


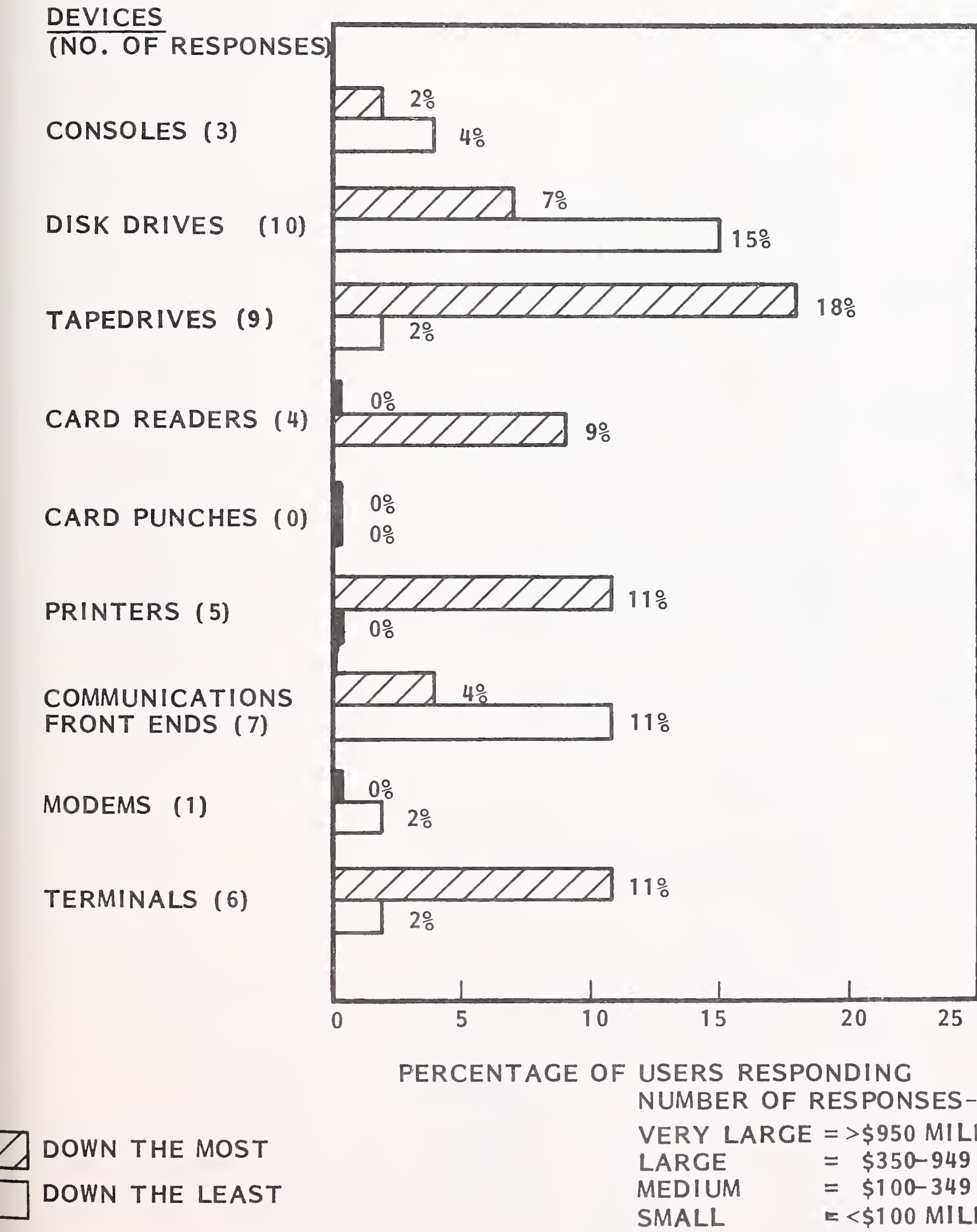
EXHIBIT C-2

AVERAGE PERCENT ANNUAL INCREASE OF RESPONDENT USER EXPENDITURES FOR GOODS AND SERVICES BY INDUSTRY SECTOR, 1979 - 1983

INDUSTRY	1979	1980	1981	1982	1983
MANUFACTURING AND DISTRIBUTION	15.2%	13.0%	13.6%	11.5%	11.5%
BANKING AND FINANCE	11.2	9.2	9.1	8.9	9.4
UTILITIES	16.3	15.8	10.0	8.6	9.4
FEDERAL, STATE AND LOCAL GOVERNMENT	9.5	8.0	8.0	8.0	8.0
OTHER	18.8	18.3	15.0	15.0	15.0

EXHIBIT C-3

VERY LARGE SIZE RESPONDENT USERS' PERCEPTIONS
OF THE DEVISES OUT OF SERVICE
THE MOST AND THE LEAST

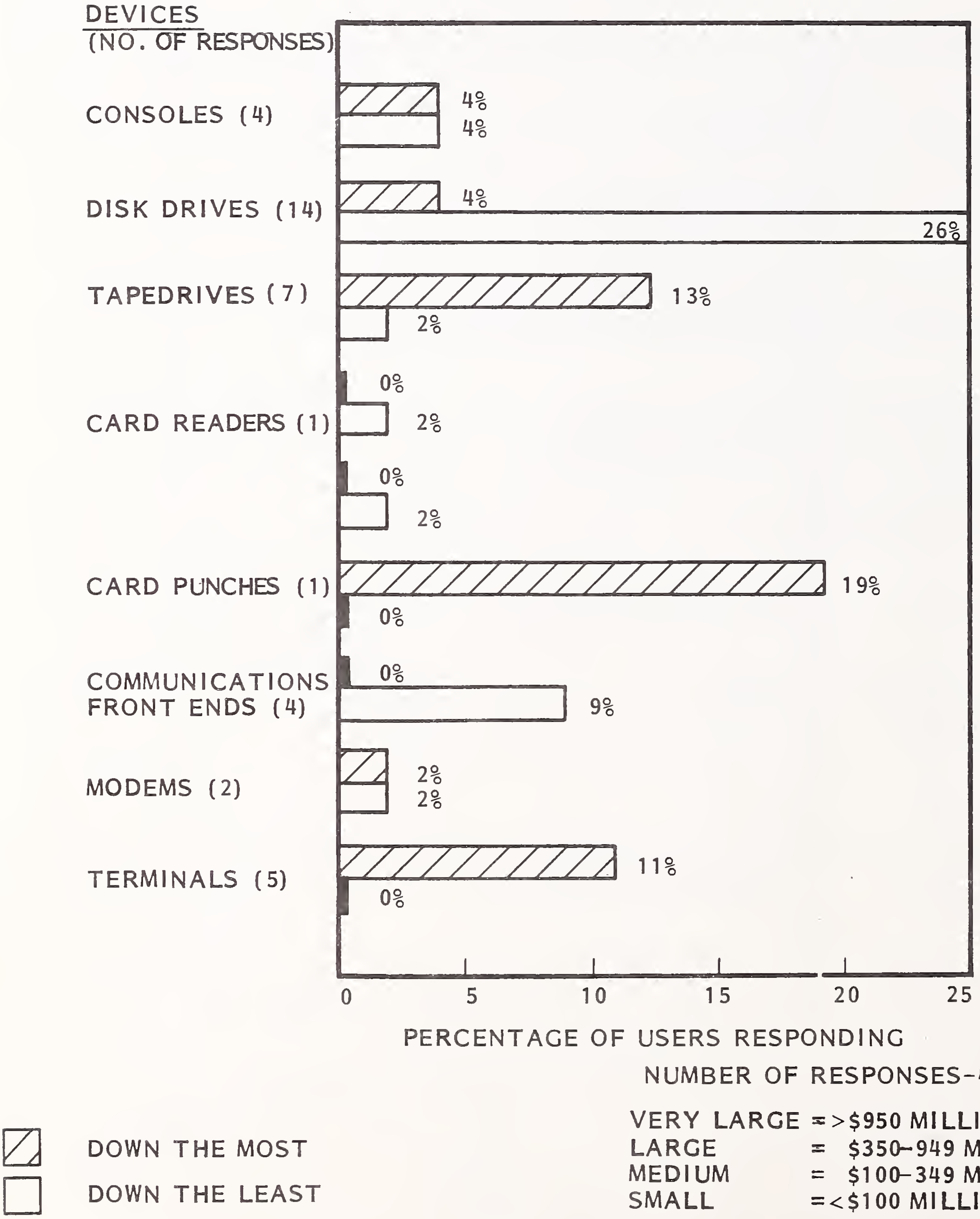


NUMBER OF RESPONSES-45

VERY LARGE = >$950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = <$100 MILLION

EXHIBIT C-4

LARGE SIZE RESPONDENT USERS' PERCEPTIONS OF
THE DEVICES OUT OF SERVICE
THE MOST AND THE LEAST

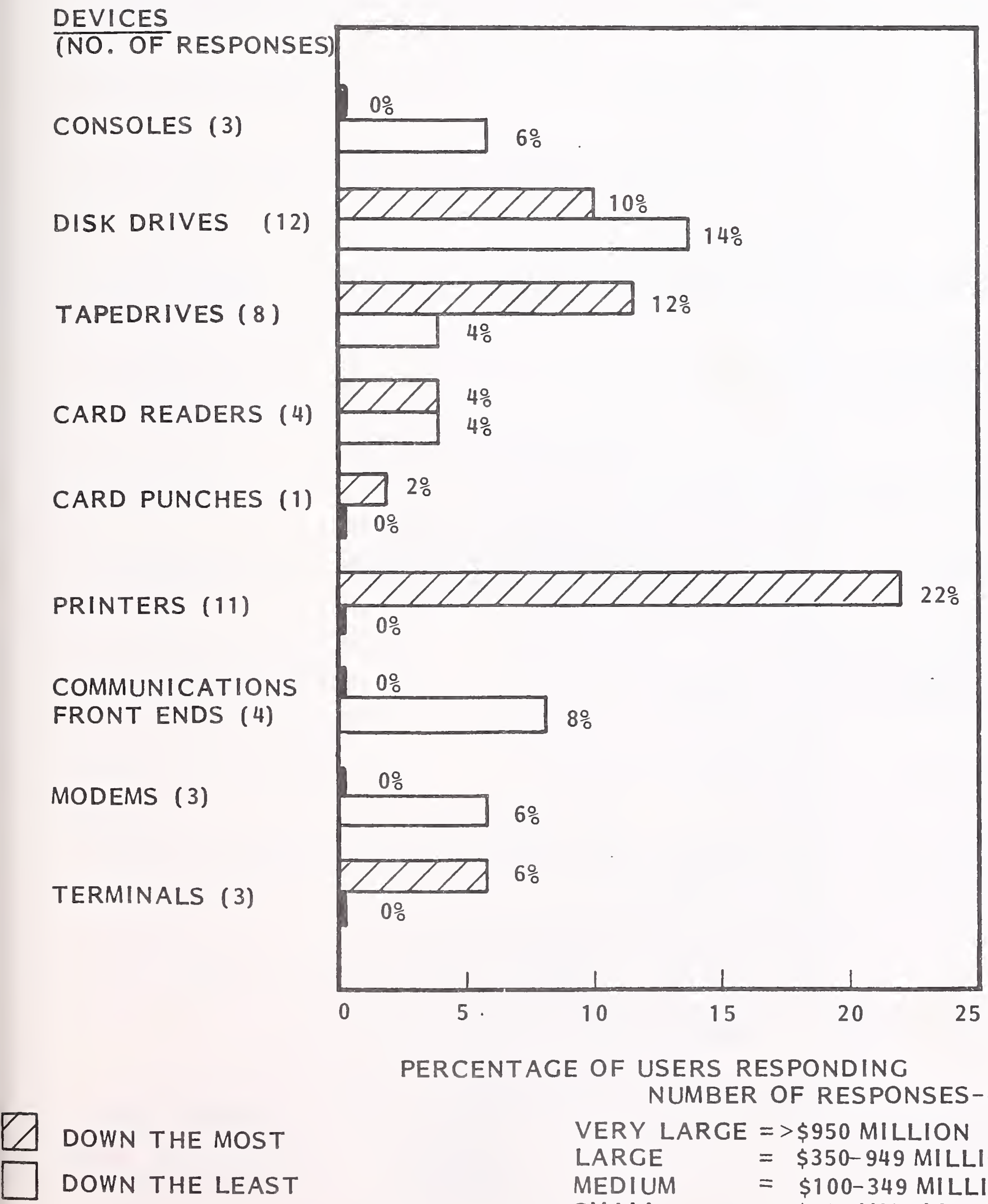


NUMBER OF RESPONSES-47

VERY LARGE = >$950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = <$100 MILLION

EXHIBIT C-5

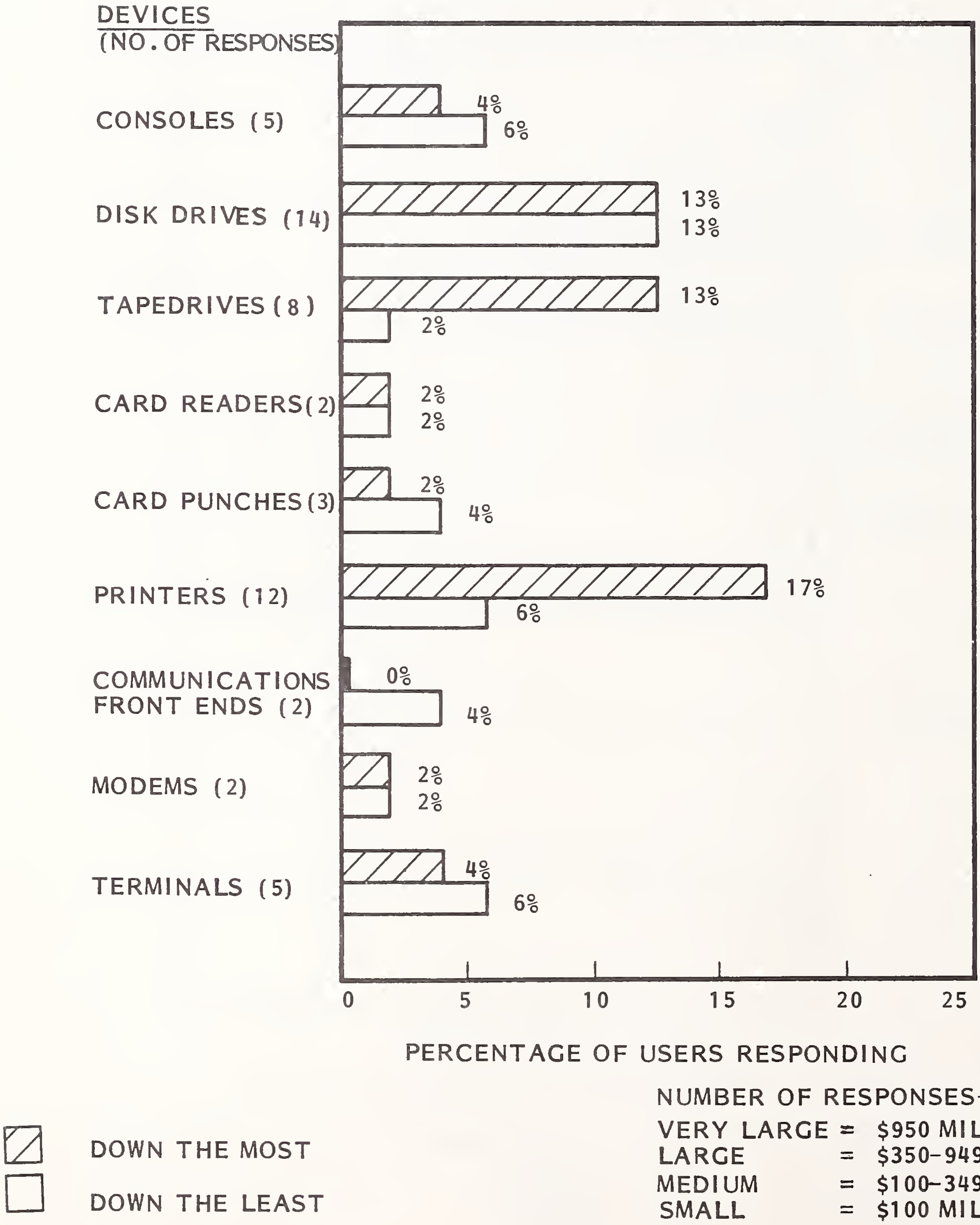
MEDIUM SIZE RESPONDENT USERS' PERCEPTIONS
OF THE DEVICES OUT OF SERVICE
THE MOST AND THE LEAST



VERY LARGE = >$950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = <$100 MILLION

EXHIBIT C-6

SMALL SIZE RESPONDENT USERS' PERCEPTIONS OF THE DEVICES OUT OF SERVICE THE MOST AND THE LEAST



NUMBER OF RESPONSES-53

VERY LARGE = $950 MILLION
LARGE = $350-949 MILLION
MEDIUM = $100-349 MILLION
SMALL = $100 MILLION

EXHIBIT C-7

RESPONDENT USER DETERMINATION OF EQUIPMENT AVAILABILITY BY (EXPANDED) CLASS OF EQUIPMENT

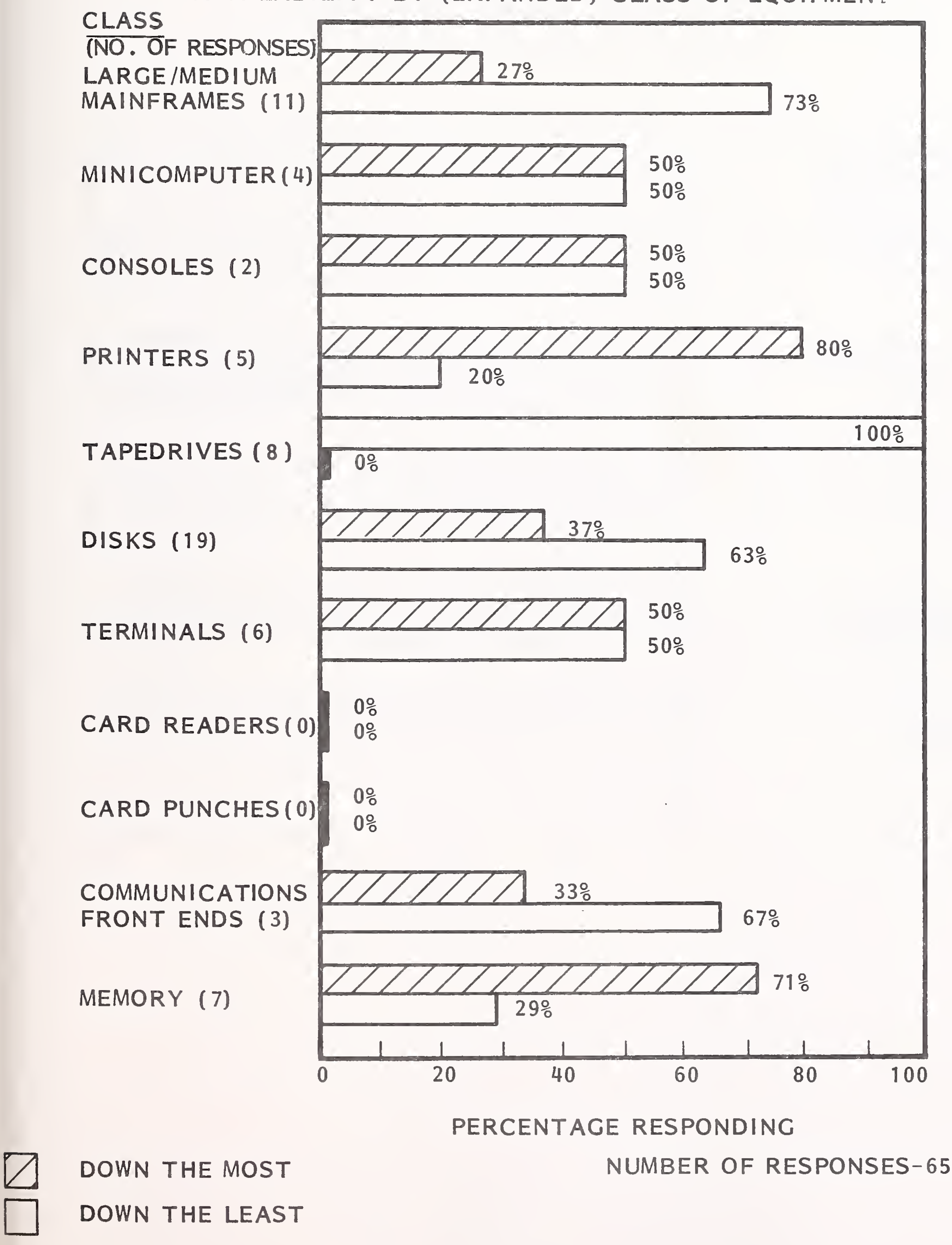


EXHIBIT C-8

RESPONDENT USERS' MINIMUM ACCEPTABLE
UPTIME BY CLASS OF EQUIPMENT

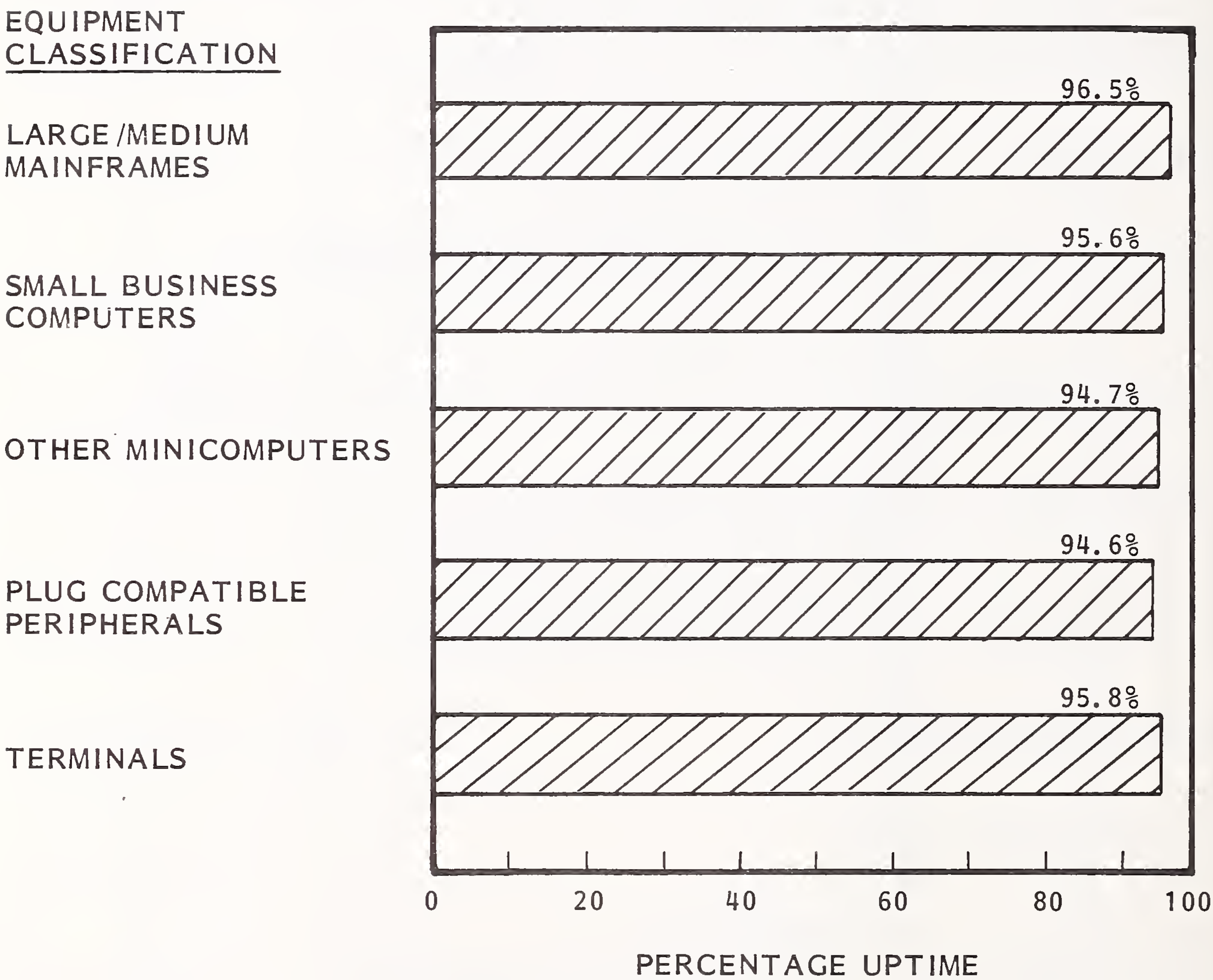


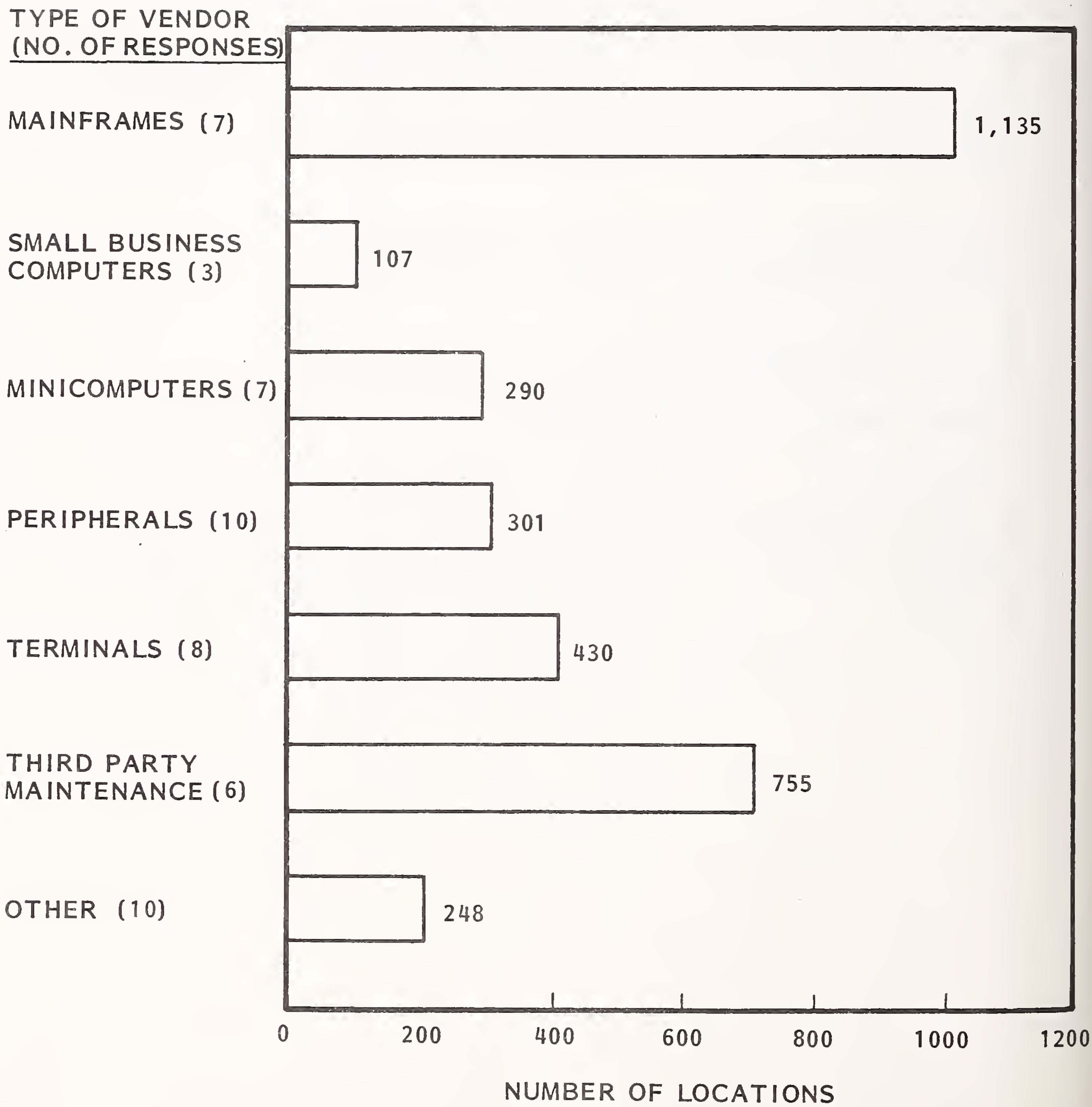
EXHIBIT C-9

EQUIPMENT INSTALLED AT YEAR END 1978 BY TYPE OF UNIT FOR RESPONDENT VENDORS

TYPE OF UNIT	NUMBER OF UNITS	NUMBER OF RESPONSES
MAINFRAMES	2,979	5
SMALL BUSINESS COMPUTERS	4,782	4
MINICOMPUTERS	8,092	6
PERIPHERALS	74,000	10
TERMINALS	305,220	11
OTHER EQUIPMENT	225,245	7
TOTAL	620,318	43

EXHIBIT C-10

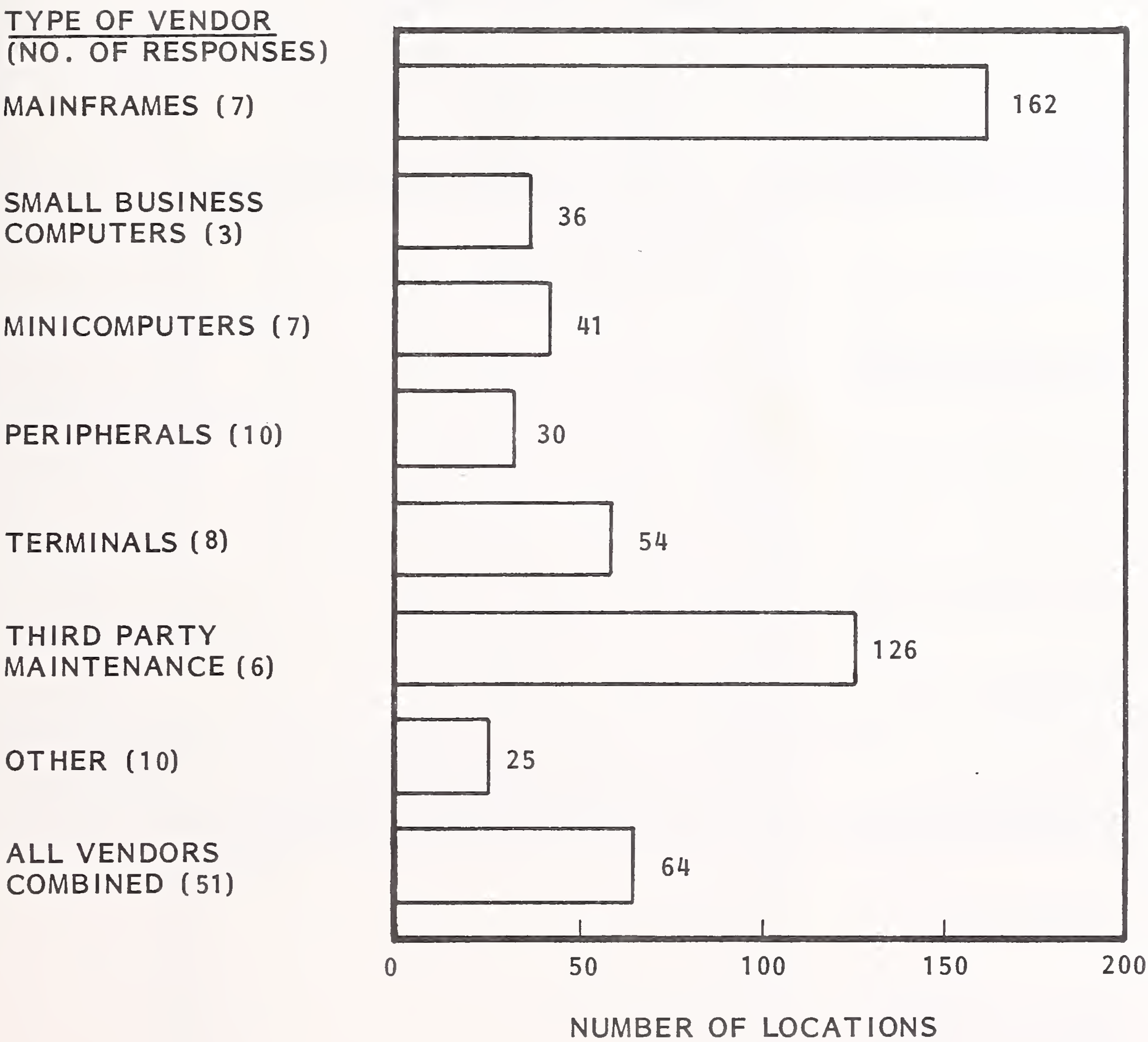
TOTAL NUMBER OF RESPONDENT VENDOR
FIELD ENGINEERING LOCATIONS



ALL VENDORS COMBINED
3,266 LOCATIONS
NUMBER OF RESPONSES-51

EXHIBIT C-11

AVERAGE NUMBER OF RESPONDENT VENDOR FIELD ENGINEERING LOCATIONS



ALL VENDORS COMBINED
3,266 LOCATIONS

EXHIBIT C-12

AVERAGE NUMBER OF RESPONDENT VENDOR FIELD ENGINEERS PER LOCATION BY TYPE OF VENDOR

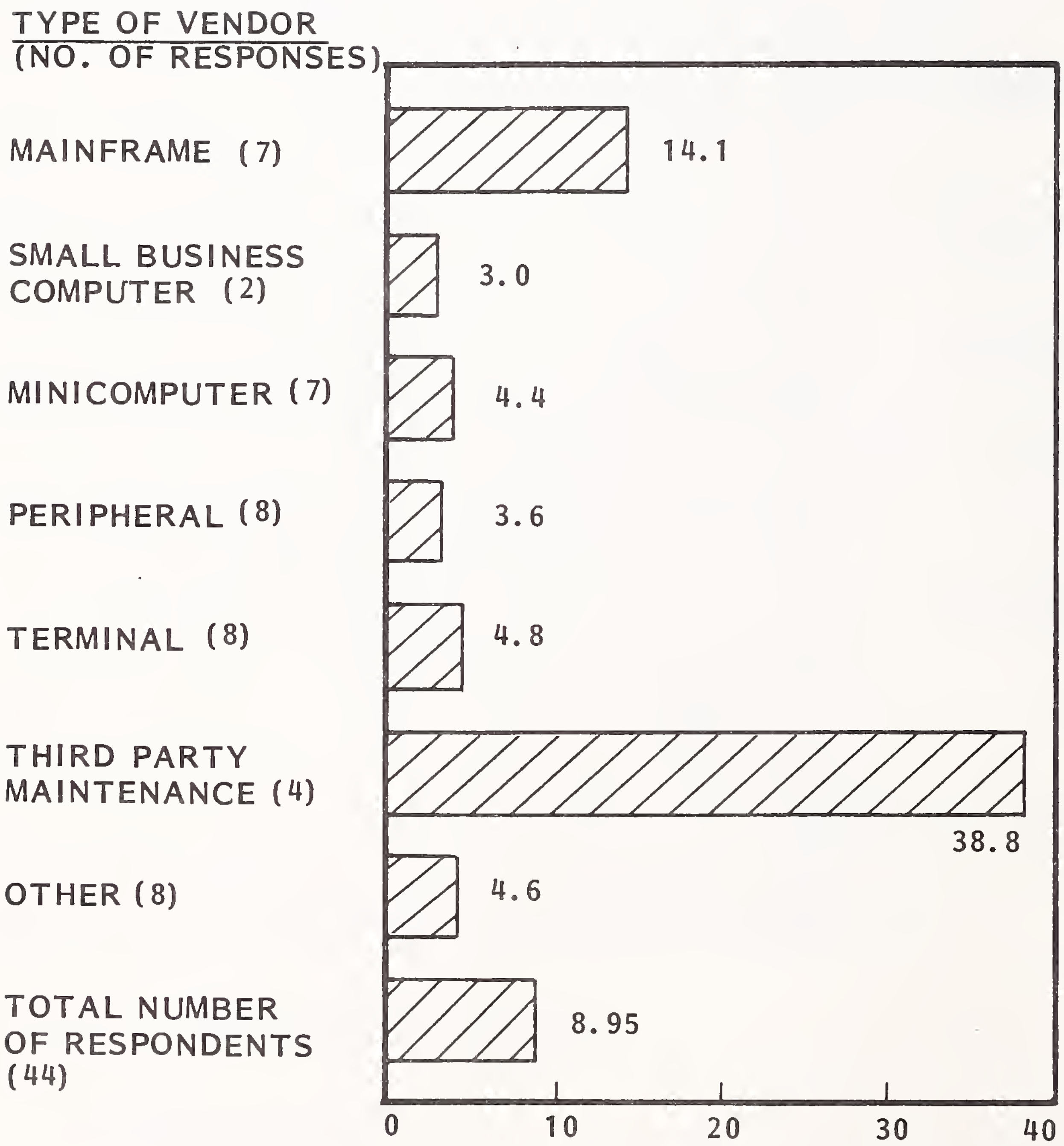


EXHIBIT C-13

RESPONDENT VENDORS' RATING OF IMPORTANCE TO THE USER OF MEAN TIME TO RESPOND

TYPE OF VENDOR	VERY IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT	
	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
MAINFRAME	7	100%	0	0%	0	0%
SMALL BUSINESS COMPUTER	3	100	0	0	0	0
MINICOMPUTER	7	100	0	0	0	0
PERIPHERAL	9	90	1	10	0	0
TERMINAL	8	100	0	0	0	0
THIRD PARTY MAINTENANCE	6	100	0	0	0	0
OTHER	10	100	0	0	0	0
COMBINED VENDORS	50	98%	1	2%	0	0%

EXHIBIT C-14

RESPONDENT VENDORS' RATING OF IMPORTANCE TO THE USER OF MEAN TIME TO REPAIR

TYPE OF VENDOR	VERY IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT	
	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS
MAINFRAME	6	85.7%	1	14.3%	0	0 %
SMALL BUSINESS COMPUTER	2	66.6	1	33.4	0	0
MINICOMPUTER	6	85.7	1	14.3	0	0
PERIPHERAL	5	50.0	3	30.0	2	20.0
TERMINAL	5	62.5	2	25.0	1	12.5
THIRD PARTY MAINTENANCE	4	66.6	1	16.7	1	16.7
OTHER	9	90.0	0	0	1	10.0
COMBINED VENDORS	37	72.5%	9	17.6%	5	9.8%

EXHIBIT C-15

RESPONDENT VENDORS' RATING OF IMPORTANCE TO THE USER OF INCREASING MAINTENANCE EXPENSES

TYPE OF VENDOR	VERY IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT	
	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS
MAINFRAME	0	0 %	3	42.8%	4	57.2%
SMALL BUSINESS COMPUTER	1	33.4	0	0	2	66.6
MINICOMPUTER	1	14.3	2	28.6	4	57.1
PERIPHERAL	0	0	5	50.0	5	50.0
TERMINAL	0	0	4	50.0	4	50.0
THIRD PARTY MAINTENANCE	2	33.3	2	33.3	2	33.3
OTHER	2	20.0	4	40.0	4	40.0
COMBINED VENDORS	6	10.0%	20	33.3%	25	41.7%

EXHIBIT C-16

RESPONDENT VENDORS' RATING OF IMPORTANCE TO THE USER OF PERFORMANCE OF PREVENTIVE MAINTENANCE

TYPE OF VENDOR	VERY IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT	
	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS	NUMBER OF RESPON-DENTS	PERCENT OF RESPON-DENTS
MAINFRAME	0	0 %	4	57.1%	3	42.9%
SMALL BUSINESS COMPUTER	0	0	2	66.6	1	33.4
MINICOMPUTER	2	28.6	3	42.8	2	28.6
PERIPHERAL	0	0	1	12.5	7	87.5
TERMINAL	1	14.3	1	14.3	5	71.4
THIRD PARTY MAINTENANCE	3	50.0	1	16.7	2	33.3
OTHER	1	10.0	4	40.0	5	50.0
COMBINED VENDORS	7	14.6%	16	33.3%	25	52.1%

EXHIBIT C-17

RESPONDENT VENDORS' RATING OF IMPORTANCE TO THE USER OF ACCOUNT MANAGEMENT

TYPE OF VENDOR	VERY IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT	
	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
MAINFRAME	4	57.1%	1	14.3%	2	28.6%
SMALL BUSINESS COMPUTER	0	0	1	33.4	2	66.6
MINICOMPUTER	1	14.3	2	28.6	4	57.1
PERIPHERAL	4	40.0	2	20.0	4	40.0
TERMINAL	2	25.0	4	50.0	2	25.0
THIRD PARTY MAINTENANCE	4	66.8	1	16.6	1	16.6
OTHER	1	10.0	4	40.0	5	50.0
COMBINED VENDORS	16	31.4%	15	29.4%	20	39.2%

EXHIBIT C-18

RESPONDING MAINFRAME VENDORS' COST ESTIMATE
FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$185	$30	$76.20	35.2%
TRAVEL	75	2	25.20	11.6%
PARTS AND MATERIALS	166	10	61.00	28.1%
OTHER	74	34	54.00	25.1%
TOTAL	$500	$76	$216.40	100.0%

(5 RESPONDENTS)

EXHIBIT C-19

RESPONDING SMALL BUSINESS COMPUTER VENDORS' COST ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$107	$36	$71.50	51.1%
TRAVEL	13	8	10.50	7.5%
PARTS AND MATERIALS	16	6	11.00	7.9%
OTHER	65	29	47.00	33.5%
TOTAL	$201	$79	$140.00	100.0%

(2 RESPONDENTS)

EXHIBIT C-20

RESPONDING MINICOMPUTER VENDORS' COST ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$120	$12	$57.20	39.1%
TRAVEL	112	3	52.00	35.5%
PARTS AND MATERIALS	30	2	18.60	12.7%
OTHER	36	1	18.50	12.7%
TOTAL	$298	$18	$146.30	100.0%

(5 RESPONDENTS)

EXHIBIT C-21

RESPONDING TERMINAL VENDORS' COST ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$67	$30	$39.43	36.6%
TRAVEL	49	6	17.83	16.6%
PARTS AND MATERIALS	120	5	32.11	29.9%
OTHER	30	2	18.17	16.9%
TOTAL	$266	$43	$107.54	100.0%

(2 RESPONDENTS)

EXHIBIT C-22

RESPONDING "THIRD PARTY MAINTENANCE" VENDORS' COST ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$86	$20	$53.00	67.1%
TRAVEL	13	1	7.00	8.9%
PARTS AND MATERIALS	20	1	10.50	13.3%
OTHER	13	4	8.50	10.7%
TOTAL	$132	$26	$79.00	100.0%

(2 RESPONDENTS)

EXHIBIT C-23

RESPONDING PERIPHERAL VENDORS' COST ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$123	$23	$69.20	40.8%
TRAVEL	65	8	27.00	15.9%
PARTS AND MATERIALS	100	9	39.40	23.2%
OTHER	34	34	34.00	20.1%
TOTAL	$322	$74	$169.60	100.0%

(5 RESPONDENTS)

EXHIBIT C-24

RESPONDING "OTHER" VENDORS' COST
ESTIMATE FOR AN AVERAGE SERVICE CALL

COST FACTOR	HIGH	LOW	AVERAGE	PERCENT OF AVERAGE TOTAL
LABOR	$117	$22	$67.25	51.8%
TRAVEL	26	5	13.70	10.6%
PARTS AND MATERIALS	84	17	31.50	24.3%
OTHER	456	12	17.33	13.3%
TOTAL	$683	$56	$129.78	100.0%

APPENDIX D: USER QUESTIONNAIRES

USER INTERVIEW

1. Industry ______________________________ .

2. Sales volume ______________________________ .

3. SIC code (or Group) ______________________ .

4. Is this location:

   a) Part of a larger enterprise? ☐ Yes ☐ No

   b) An independent enterprise? ☐ Yes ☐ No

5. Functions performed at this location. (Check all that apply)

   a) R & D ☐ b) Manufacturing ☐

   c) Sales ☐ d) Warehousing ☐

   e) Accounting ☐ f) Administrative ☐

   g) Other ☐
   (Describe)

Financial and personnel data.

6. a) Total number of employees:

   i) At this facility ____________

   ii) Under the jurisdiction of this facility ____________

   b) EDP employees:

   i) At this facility ____________

   ii) Under the jurisdiction of this facility ____________

7. What is your EDP budget for 1978? $ ______________

8. What percentage growth in the EDP budget do you foresee? (current dollars)

a) 1978 to 1979: ________ %

b) 1979 to 1980: ________ %

c) 1980 to 1981: ________ %

d) 1981 to 1982: ________ %

e) 1982 to 1983: ________ %

9. What is your projected distribution of EDP expenses? ($ and/or %)

Factor	(A) 1978	(B) 1980	(C) 1983
a) Medium/Large Systems	$ %	$ %	$ %
b) Mini/Small Business Computer Systems	$ %	$ %	$ %
c) Terminals	$ %	$ %	$ %
d) Data Communications	$ %	$ %	$ %
e) Personnel	$ %	$ %	$ %
f) Maintenance	$ %	$ %	$ %

10. * Eliminated detail for fortune 100/10 Companies.

The Following Questions Relate To Your <u>Total</u> Organization	(i) Medium (370/125-140) & Large (158+) Mainframes (Total System)	(ii) Small Business Computers	(iii) Other Minicomputers	(iv) Peripherals (Plug Compatible) (Memory, Disk, Tape Drives)	(v) Terminals
* a) Describe units installed (Quantity, Make, and Model)					
b) Purchase Price or Monthly Lease Expense for Equipment Listed					
c) Monthly Maintenance Expenses (1978) for Equipment Listed (Ref: 9 f)					
d) Anticipated Increase in Maintenance Expense (1978-1979)					

11. Rate the importance to you of the following field maintenance characteristics: (5 = highest, 1 = lowest)

Factor	Rating	Rank 5s
a) Mean Time to Respond (in person)		
b) Mean Time to Repair (of equipment) (Not include response time)		
c) Performance of Preventive Maintenance		
d) Maintenance Expenses Increasing 8-10%/Year		
e) Account Control		
f) Other		

12. List the vendor performing maintenance (manufacturer, third party, user, etc.) for the following equipment, and rate your satisfaction with his performance (5 = excellent; 1 = very poor)

EQUIPMENT CLASSIFICATION	(i) MAINTENANCE VENDOR	(ii) RATING	(iii) USING TIME AND MATERIAL (TM) OR CONTRACT (C)
a) Medium and Large Mainframe Systems			
b) Small Business Computers			
c) Other Mini-Computers			
d) Peripherals (Plug Compatible)			
e) Terminals			

f) Comment on 12a-e (iii)

13. Would you prefer using: hardware vendor or third party for maintaining your systems as indicated (check appropriately)

EQUIPMENT CLASSIFICATION	(i) ONLY USE VENDOR	(ii) PREFER VENDOR	(iv) NO DIFFERENCE	(iv) PREFER THIRD PARTY	(v) ONLY USE THIRD PARTY
a) Medium and Large Main-frames system					
b) Small Business Computers					
c) Other mini-computers					
d) Peripherals (plug com-patable)					
e) Terminals					

14. Would you as a user, consider the following?

	Yes or No	Comment
a) Install equipment yourself.		
b) Cooperative testing by running diagnostics before calling vendor for maintenance help.		
c) Actually performing maintenance on your product or system.		
d) Deliver equipment to vendor maintenance depot for repair or replacement.		

e) Are you presently doing a, b, c, d? ☐ Yes ☐ No. Describe:

14. f) What percentage cost savings would you require for performing your own maintenance?

    i) < 10% __________

    ii) 11-20% __________

    iii) 21-30% __________

    iv) > 30% __________

    v) Would not consider __________

    g) What do you require for maintenance:

    Coverage

    i) Shifts/Day: ______________________

    ii) Days/Week: ______________________

    iii) Comments concerning the future:

15. Do you have distributed data processing (DDP) in your company now?

    a) Yes ________

    b) No ________

    c) If "no," when are you planning to?

    i) 19 ______

    ii) Undecided ________

    iii) Never ________

    iv) If "never," why?

16. What do you consider as the minimum acceptable performance?

EQUIPMENT CLASSIFICATION	PERCENTAGE UPTIME (%)	MEANTIME BETWEEN FAILURE (HOURS)	MEANTIME TO REPAIR (HOURS)	MEANTIME TO RESPOND (HOURS)
a) Medium and Large Main-frames				
b) Small Business Computers				
c) Other Mini-computers				
d) Peripherals (plug com-patible)				
e) Terminals				

17. What are you currently receiving and how much extra (%) would you spend for an improvement in mean time to respond (X) and mean time to repair (Y)?

Product Line	Mean Time to Respond(X)/Repair(Y) (Hours)		Absorb Extra Cost
	Present Actual (X/Y)	Required or Desired (X/Y)	(%)
a) Main Frame System	/	/	/
b) Small Business Computer	/	/	/
c) Mini - Computer	/	/	/
d) P.C. Peripherals	/	/	/
e) Terminal	/	/	/

18. Except for the initial installation, what device in your present equipment was down (outage) for the longest continuous period?

a) Type ____________________

b) Manufacturer ____________________

c) Maintenance Vendor ____________________

d) How long was the outage in elapsed hours? ____________

Reason for outage?

e) Could this have been prevented? Yes ______ No ______

f) If "yes," how?

g) If "no," why?

19. a) Except for the mainframe(s), rate which group of devices are most disruptive when out of service: (5 = most, 1 = least) and rank 5 s.

FACTOR	RATING	RANK 5s
i Console		
ii Disk Drives		
iii Tapes		
iv Card Reader		
v Card Punch		
vi Printer		
vii Com. Front End		
viii Modems		
ix Terminals		

19. b) In your opinion, which of the above units is down the most? ________ the least? ________

20. If you have multiple vendor's equipment installed, (main frames and peripherals), whose is down the most?

a) Vendor Name ________

b) Type ________

c) Maintenance Vendor ________

Whose is down the least?

d) Vendor Name ________

e) Type ________

f) Maintenance Vendor ________

21. During the last two years, have you or are you in the process of replacing any equipment because of poor maintenance?

a) Yes ________

b) No ________

c) If "yes,":

i) Vendor Name ________

ii) Type ________

iii) Maintenance Vendor ________

d) The availability (uptime) of the new equipment is:

a) Better ________

b) About the same ________

c) Worse ________

d) Not yet installed ________

22.a) List any vendors whose equipment you would refuse to consider in the future due to past maintenance problems:

b) Why?

23. Of the companies (manufacturer or third party) performing maintenance on your equipment, rate them overall and on the basis of their performing preventive maintenance (PM): (5 = very effective, 1 = very poor)

Company	Overall Rating	PM Performed (check)		Rating (PM)
		On Shift	Off Shift	
a)				
b)				
c)				
d)				
e)				

24. For what percentage of cost saving in your maintenance contract would you eliminate preventive maintenance (PM)? (Encircle)

   a) Would not consider elimination of PM.

   b) 5% of contract cost

   c) 5-10% of contract cost

   d) 11-20% of contract cost

   e) 21-30% of contract cost

   f) >30%

25. Rate the reasons for your <u>presently</u> using or <u>considering</u> using (encircle appropriately) a third party maintenance organization: (5 = highest, 1 = lowest)

Factor	Rating	Rank 5 s
a) Less Expensive (i) Minimum Percentage: ______%		
b) Manufacturer(s) does not provide service in area (i) Maximum Time to Respond Allowed Manufacturer: ________ hours		
c) Multi-Vendor Installation		
d) Attitude of Service Person		
e) Other Reasons for Dissatisfaction (e.g.:)		

26. What are your preferences as a user towards a maintenance person concerning the following factors?

(Prefer (P), Indifferent (I), Dislike (D))

Factor	Preference
a) Male	
b) Female	
c) Shirt and Tie (For Male)	
d) Shoulder Length Hair (for male)	
e) Uniform (Coveralls, etc.)	
f) Seems to be Constantly On Site (whether or not working)	
g) Usually the Same Individual Maintaining the Equipment	
h) Other	
i) Other	

27. What, in your opinion, would improve your maintenance service the most?

28. What maintenance needs or service requirements do you have which are not now being met?

29. Do you believe there are differences in maintenance requirements for the following product categories compared to "information processing equipment"?

    a) Automated office equipment: ☐ Yes ☐ No

    b) Comment:

    c) PABX equipment: ☐ Yes ☐ No

    d) Comment:

APPENDIX E: VENDOR QUESTIONNAIRES

CATALOG NO. | M | T | V | | | |

VENDOR INTERVIEW

1. Type of vendor (check appropriately): (encircle product(s) for this questionaire)

   a) Mainframe manufacturer ____________

   b) Small business computer manufacturer ____________

   c) Mini computer manufacturer ____________

   d) Peripheral (plug compatible) manufacturer ____________

   e) Terminal manufacturer ____________

   f) Third party maintenance organization ____________

   g) Computer services vendor ____________

   h) Other (describe) ____________

2. a) What is the title of the senior corporate maintenance executive?

   b) To whom does he presently report?

   c) To whom do you think he'll report in 1980?

   d) What functions report to him:

3. How many maintenance depots do you have, and where are they located?

4. How many field engineering locations do you have?____________________

5. Number of employees in your maintenance organization:

   a) Total headcount: ______ (a = b+c+d)
   b) Field engineer count: ______
   c) Field management count: ______
   d) Administrative count: ______

6. What is the size of an average field location?

   a) Direct employees (maintenance engineers):

   b) Support personnel:

   c) Budgeted revenue/year:

   d) Budgeted cost/year:

CATALOG NO. | M | T | V | | | |

7. We are interested in your source for obtaining, or means of training, field maintenance engineers for your organization. Please rate the importance of these sources (on a scale of 5 = highest number of people, 1 = lowest number of people) for 1978 and projected for 1982:

FACTOR	RATING (1978)	RANK 5s	RATING (1982)
a) Hire and train yourself			
b) Recruit from competition			
c) Recruit from other industries			
d) Trained discharged Armed Forces personnel			
e) Recruit from other functions within your company (e.g.: manufacturing, engineering)			
f) Trade Schools			
g) Other (describe)			

8. What are the 3 most important reasons for your losing (or separating) field maintenance engineers?

a)

b)

c)

9. a) Do you have a formal training program for field engineers for:

(i) hardware? ☐ Yes ☐ No

(ii) software? ☐ Yes ☐ No

b) If "No", why?

(i) hardware:

(ii) software:

c) If "Yes":

Equipment	Average Training Days		Class Size	Cost Per Student Day (less travel and living)
	Hardware	Software		
(i) Medium/Large Mainframe				
(ii) Small Business Computer				
(iii) Mini Computers				
(iv) Plug Compatible Peripheral				
(v) Terminals				

9. d) Total number of student days: (if they don't know, then get # of classes taught per year)

   (i) 1978 __________

   (ii) 1979 percent increase: __________%

   e) Number of Instructors:

   (i) 1978 __________

   (ii) 1979 percent increase: __________%

1978

10. a) Total new hires (field engineers): ____________________

    b) Total separations (field engineers): ____________________

11. Additional (net) field maintenance headcount requirements anticipated:

	PERCENTAGE: increase/ decrease
a) 1979:	
b) 1980:	
c) 1981:	
d) 1982:	
e) 1983:	
f) Comments:	

12. a) Do you have an incentive program for field engineers?

☐ yes ☐ no

b) Describe:

13. At what "level" do you on-site replace or repair? (Check appropriately).

LEVEL	1978	1982	REPAIR LOCATION
a) component level			*
b) board level			*
c) unit level			

* (Plant (P), Depot (D), On Site (O)) (N/A for 1982)

14. Please estimate for December, 1978:

a) $\frac{\text{Spare parts investment (manufacturing or procurement cost)}}{\text{Value of units or systems maintained (manufacturing cost)}}$ = ________ %

b) Spare parts investment as a % of maintenance revenue ________ %

15. Please break down into the following categories all units or systems of your product line presently installed in the U.S.

a) Maintained by your organization: ________ %

b) Maintained by a third party maintenance organization : ________ %

c) Maintained by the user : ________ %

d) Maintained by a distributor, systems house or integrator : ________ %

e) Other (describe) : ________ %

f) Don't know : ________ %

100 %

16. a) What percentage of total field engineering man hours was spent in installing ECNs (Engineering Change Notices) during 1978? ________%

b) Comments:

17. a) Average number of "trouble calls" monthly __________. (total # all units)

b) What percentage of (a) are "repeat calls"?__________%
(Additional call within 2 week period.)

c) What percentage of (a) had no faults found? ________%

d) For (c) the customer is: (Check)

(i) Billed 100% of the time__________

(ii) Billed > 50% of the time__________

(iii) Billed some of the time__________

(iV) Never billed __________

INPUT

PROJECT CODE: X-MNT

CATALOG NO. | M | T | V | | | |

18. As you perceive it, rate the importance to your customer for the following field maintenance characteristics: (5 = highest, 1 = lowest)

(i.e., How important are the following field maintenance characteristics to your customer?):

FACTOR	RATING	RANK 5s
a) Mean Time to Respond (in person)		
b) Mean Time to Repair (of equipment)		
c) Performance of Preventive Maintenance		
d) Maintenance Expenses Increasing 8-10%/Year		
e) Account Management		
F) Other		

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CATALOG NO. M T V _ _ _

19. What is the average estimated time that you provide to your customers for the products marketed:

EQUIPMENT CLASSIFICATION	PERCENTAGE UPTIME (PERCENT)	MEANTIME BETWEEN FAILURE (HOURS)	MEANTIME TO REPAIR (HOURS)	MEANTIME TO RESPOND (HOURS)
a) Medium and Large Mainframes				
b) Small Business Computers				
c) Other Minicomputers				
d) Peripherals (plug compatible)				
e) Terminals				

20. In your opinion, rate your maintenance operation in relation to competition for the following factors: (5 = excellent, 1 = poor)

FACTOR	RATING	RANK 5s
a) Personnel turnover		
b) Meantime (MT) to respond		
c) Meantime (MT) to repair		
d) Meantime (MT) between product failure		
e) Total customer satisfaction		
f) Other		

21. a) Do you presently use a third party maintenance organization for maintaining any of the products your company markets?

☐ Yes ☐ No

b) If "no," under what conditions would you consider it?

c) Would you consider maintaining products other than those marketed by your company?

(i) already do ____________

(ii) yes ____________

(iii) no ____________

d) Would you want your customer to diagnose faults in his equipment?

☐ Yes ☐ No

e) Do you think your customer will deliver his faulty product to a maintenance depot for repair or replacement?

☐ Yes ☐ No

CATALOG NO. | M | T | V | | | |

22. Rate the following factors as they present problems in your maintenance organization: (5 = most important; 1 = least important) (get 2-3 most important, at least)

FACTOR	RATING	RANK 5s
a) Morale of maintenance force		
b) Recruiting field maintenance personnel		
c) Training field maintenance personnel		
d) Reducing labor turnover		
e) Product quality		
f) Adequate diagnostic equipment		
g) Adequate remote diagnostic assistance		
h) Marketing demands		
i) Customer demands		
j) Budget limitations		
k) Salary Administration		

INPUT

23\. What maintenance revenues are forecasted for the product lines and years indicated? (Complete for products within interviewers responsibility.)

PRODUCT LINE	1978	1980	1982
a) Mainframe System	$	$	$
b) Small Business Computers			
c) Mini-Computers			
d) P.C.P.			
e) Terminals			

24\. Do you consider (in your company) maintenance as a

a) Profit generator ________

b) Cost Center ________

c) Comments: (Interviewer comments especially important here)

d) What do you estimate is the 1978 maintenance profit/(loss) for the product line(s) surveyed?

Profit ________ Loss ______

25. What is your cost estimate for an average service call and how is it built up?

a) Labor $__________

b) Travel $__________

c) Part and Materials $__________

d) Other (describe) $__________

e) Total $

26. What are the formulas or ratios for the following maintenance arrangements:

FACTOR	HARDWARE	HARDWARE & SOFTWARE
a) Time and materials :	$	$
b) One shift x 5 days :	100 %	100 %
c) 2 shifts x 5 days :	%	%
d) 3 shifts x 5 days :	%	%
e) 2 shifts x 6 days :	%	%
f) 3 shifts x 6 days :	%	%
g) Other (describe) :	%	%

27. What is the 1978 average percentage for:

What is the average maintenance charge/year? ________

What is the average purchase price of equipment? ________ = ________%

a) Mainframe System ________%

b) Small Business Computer ________%

c) Mini-Computer ________%

d) P.C.P. ________%

e) Terminals ________%

28. What changes in maintenance techniques do you foresee as a result of rising labor costs and increasing product/price performance:

a) 1979:

b) 1982:

c) 1985:

29. Rank the following factors as to what you believe will be their impact over the next 5 years on your presently used maintenance techniques (5 = greatest impact, 1 = no impact)

FACTOR	RATING	RANK 5s
a) Rising labor costs		
b) Increasing product price performance		
c) User performing own maintenance		
d) User and vendor cooperatively testing transmission or computing equipment		
e) Home or personal computers		
f) Multi-function equipment		
g) Built-in diagnostics		
h) Remote diagnostics (via telecomunications)		
i) Distributed data processing		
j) Advances in technology		
k) Other (describe)		

30. Please discuss the factors rated "5" in the previous question:

a)

b)

c)

31. In your company, who "sells" maintenance contracts?

a) Salesman ____________

b) Maintenance representative ____________

c) Other (describe)

d) Is there a commission plan: ☐ Yes ☐ No

e) If "Yes" to d), describe:

32. a) Do field maintenance engineers sell other products? ☐ Yes ☐ No

b) Describe

33. What indices do you use to measure field engineer productivity?

34. What do you believe would do the most in improving the services currently provided to your user?

Thank you very much!